A SOCIAL EPIDEMIOLOGY OF FOODWORK AND HOME-PREPARED FOOD

Chloe Clifford Astbury

Darwin College

Centre for Diet and Activity Research & MRC Epidemiology Unit

School of Clinical Medicine

University of Cambridge

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DECLARATION

This dissertation is the result of my own work under the supervision of Dr Jean Adams and Dr Tarra Penney. It has not been previously submitted, in part or whole, to any university or institution for any degree, diploma, or other qualification. This dissertation does not include work done in collaboration except where specifically indicated in the text below.

The studies presented here used data collected by the National Diet and Nutrition Survey team at the MRC Elsie Widdowson Laboratory and UK Time Use Survey teams at the Centre for Time Use Research. For all studies, I conceived of the objectives, prepared and analysed the data, interpreted the findings and led the writing of all manuscripts, both published and in preparation. Through all the stages of this research, Dr Adams and Dr Penney provided advice and critical feedback on all studies. In addition, Dr Louise Foley of the Global Diet and Activity Research Group and Network provided advice and critical feedback on the studies presented in Chapters 2 and 3.

In accordance with the guidelines of the Degree Committee of the Faculties of Clinical Medicine and Veterinary Medicine, this thesis does not exceed 60,000 words.

Signed:____

Date:____

Chloe Clifford Astbury, BA, MPhil

Cambridge

SUMMARY

A social epidemiology of foodwork and home-prepared food

Chloe Clifford Astbury, January 2020

A significant amount of energy and resource has been devoted to promoting home food preparation, based on the hypothesis that it is an important, modifiable determinant of diet composition and quality. Ideas about the importance of home food preparation to good nutrition have permeated into policy, with a number of countries emphasising home food preparation and home-prepared food in their dietary guidelines and food guides. These policies encourage individuals to maintain 'traditional' domestic food practices in order to eat healthily, even while the food system, along with other dimensions of life such as working hours and leisure activities, are undergoing substantial change.

Interventions have often focused on boosting skills, guided in part by public and academic discourse that posits that people are cooking less than they did in the past because they no longer know how. This idea persists despite evidence that most people feel their skill set to be adequate to their needs, and cite other barriers, including, notably, a lack of time. Concerns have been raised surrounding both the effectiveness of encouraging home food preparation as a strategy to improve dietary quality, and its repercussions for equity, with foodwork still being predominantly undertaken by women, and with those who are time-poor being potentially less able to adopt time-intensive approaches to food provisioning. Further, there is a certain lack of clarity surrounding what is being encouraged: not all foodwork produces foods that might be defined as 'home-prepared'.

This thesis aims to present a social epidemiology of foodwork and home-prepared food consumption, using nationally representative data from UK adults to:

1) Investigate how a ‘lack’ of time, in the form of competing demands on and other uses for time, is associated with time allocated to foodwork; and
2) Explore the association between home-prepared food consumption and diet quality.

First, analysis of three waves of cross-sectional UK time use surveys, spanning three decades, demonstrated that both participation in foodwork and time spent on foodwork continued to decrease. A compositional data analysis approach was used to put this in the context of other daily activities, examining how time spent on activities such as work, sleep and leisure has evolved in tandem with time spent on foodwork. Results suggest that time devoted to work, paid and unpaid, has not increased substantially over this period. Instead, more time is spent on sleep and screen time.

Second, analysis of the most recent wave of the UK time use survey compared how participants who did no foodwork, some foodwork, or a lot of foodwork allocated their time differently. Participants who spent more time on foodwork also spent less time on sleep, although not on screen time. Foodwork was predominantly done by women, and women who did more foodwork increased time spent on work (both paid and unpaid) and reduced time spent on leisure and personal care activities more substantially than their male counterparts.

Third, a measure of home-prepared food consumption based on food diaries was developed using data from the UK National Diet and Nutrition Survey, and compared to a more orthodox measure: self-reported frequency of meals being prepared at home in participants’ households. These measures were significantly associated with one another, and this association did not vary systematically between most socioeconomic and demographic groups.

Fourth, the food diary-based measure of home-prepared food was deployed to estimate consumption levels in the UK population (around a third of energy intake), and to determine the association between home-prepared food consumption and dietary quality. A moderate, though significant, association was found between the two. However, there was limited variation in the consumption of home-prepared food or its association with diet quality between different socio-demographic groups, suggesting that other components of diet may be responsible for consistently reported inequalities in diet quality.

Finally, we explored the possibility of eating healthily where extensive foodwork was not possible or desirable by identifying individuals who ate healthily with minimal reliance on home-prepared food, describing their intake in terms of food and nutrients, as well as their socio-demographic characteristics.

As a whole, this work suggests that, while foodwork and home food preparation continue to play a role in how people in the UK spend their time and provision their food, other ways of eating also play an important, and potentially growing, role, and may not always necessarily be detrimental to health. Interventions that seek to improve dietary quality at the population level must take a full account of contemporary life, supporting individuals in eating healthily through a diverse range of approaches to food.

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This thesis relies exclusively on existing survey data. I would like to express my gratitude to the many participants who provided it, and to the researchers and study team members who collected and worked on it. Without their efforts this work would not exist.

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List of Abbreviations and Acronyms

NDNS – National Diet and Nutrition Survey

MTUS – Multinational Time Use Study

UKTUS – United Kingdom Time Use Study

MFP – Main food provider

HPF – Home-prepared food

DASH – Dietary approaches to stopping hypertension

LIST OF APPENDICES

1 INTRODUCTION

1.1 Overview

This chapter outlines the context in which this thesis was undertaken, lays out the overall aims of the thesis, and introduces the remaining chapters. It begins by outlining the existing evidence for change in domestic food practices over time, the debate surrounding the extent and importance of these changes, and the key questions that need answering in determining whether to advocate for and intervene in home food preparation practices (1.2 Foodwork and home-prepared food in the 21st century). Second, it presents the existing evidence on the topic, outlining how 'foodwork' and 'home-prepared food' have been defined and measured, then looking at outcomes, barriers and approaches to increasing home food preparation and consumption, finishing with a note on how terminology will be used in the thesis (1.3 Foodwork and home-prepared food: definitions, measurement and evidence). Third, it evaluates the available evidence in light of the key questions in the field, determining to what extent this evidence provides answers to these questions (1.4 Advocating a return to the kitchen: questions surrounding feasibility, necessity and equity). Finally, it states the overall thesis aims and summarises the remaining chapters (1.5 Overall aims and summary of thesis chapters).

1.2 Foodwork and home-prepared food in the 21st century

1.2.1 A crisis in cooking? Changing food practices in the UK and around the world

Given the potential role a healthy diet could have in preventing overweight and obesity, heart disease, cancer and diabetes,[1–5] improving dietary quality at the population level emerges as one of the highest priorities in public health. The rise in diet-related diseases arrives in tandem with an increase in the consumption of food prepared outside the home over the second half of the 20th century.[6,7] The same period has seen a decrease in time spent on home food preparation and its attendant tasks, or 'foodwork', in several high-income countries, including the UK.[8–10] These parallel trends in diet-related disease and food practices have prompted substantial interest and investment in understanding the modifiable determinants of making and eating 'home-prepared' food, with a focus, in particular, on cooking skills.

Empirical investigations have explored changes in food practices over time, using time use diaries and household expenditure surveys, as well as other historical records, as proxies for these practices.

Analyses using time-use diaries have predominantly focused on the latter half of the 20th century. In the UK, Cheng and colleagues found that time spent on two domains of foodwork – home food preparation and washing dishes/clearing up – decreased by 16 minutes for the average UK adult between 1975 and 2000. Meanwhile, participation in the task increased from 75% to 83% of the sample, driven principally by the increased number of men engaging in home food preparation.[10] The authors examined the practice of eating as a whole, claiming that this period had seen an overall transition from more domestic to more commercial foodways, reflected in their analysis of time spent eating in different locations (in and outside the home) as well as in their analysis of time spent on foodwork.[10] They hypothesised that the reduction in time spent on preparation and washing up reflected, in part, an increase in the frequency of dining outside the home, but also the impact of convenience foods being more thoroughly integrated into food practices, in combination with new technologies, like freezers and microwaves. However, the authors also concluded that the changes in the practice of eating were less 'radical' than was sometimes claimed.

Analyses of time use diaries from other countries, including Germany, the United States, France, Norway and the Netherlands,[8,9,11,12] identified similar trends over this period, although a certain amount of variation exists between countries. It is not clear whether this downward trend in time spent on foodwork overall, or the increase in men's involvement in foodwork, has continued into the 21st century in the UK. In the United States, trends in foodwork appear to be changing: time spent on home food preparation increased between 2003 and 2016, with most groups showing an increase in both participation and time spent.[13] Nevertheless, inequalities persisted, with women, and less educated women in particular, doing substantially more foodwork than other groups.

Over the same period, household expenditure surveys suggest an upward trend in spending on out of home foods that corresponds to the downward trend in time allocated to domestic foodwork. In the UK, analyses suggest that, as a share of total household food expenditure, spending on foods to be eaten or prepared at home has decreased, while spending on eating outside the home has increased.[14,15] A similar pattern has been identified in data from the United States.[9]

Other sorts of historical records have allowed inferences to be drawn about how eating and food practices have evolved, sometimes over longer periods of time. Trubek draws on historical records of workers in different occupations to bring new light on food preparation practices in and outside the home in the United States.[16] She suggests that the 20th century saw a transition in cooking as an *occupation*, with the number of people employed as cooks outside the home – in restaurants, cafes and canteens – increasing substantially, from 200,000 to 2,000,000 nationally, while the number of general domestic service workers, who would, among other tasks, have cooked for the households in which they were employed, decreased. Trubek concludes that cooking as a paid occupation has existed for a long time, as has the corresponding practice of eating food prepared by others. However, as paid cooks in private households have become less common, appearing instead in public dining locations, the number of people who eat food prepared by others has become much larger, as well as encompassing a broader cross-section of the population. It also seems plausible that this transition has impacted the sorts of food prepared by those who cook as a paid occupation, from more domestically to more commercially processed foods.

Where data *from* the past is not available, scholars have sought to understand how practice is changing by gathering, in the present, data *about* the past. However, this sort of 'retrospective' research around food presents certain pitfalls. An analysis of mothers' perceptions of involving their children in cooking, conducted on the island of Ireland, concluded that the culture of children in the kitchen had changed dramatically.[17] While most of the mothers who participated in the study reported having learned to cook from their own mothers through regular and extensive engagement in foodwork during their childhoods, they noted that they were 'failing' to replicate this transference of skills to their own children, lacking the time and the energy to regularly involve them in foodwork.[17] Many participants expressed feelings of guilt around this perceived failure.

A further study, conducted by Merin Oleschuk in Toronto, Canada, with an ethnically and socioeconomically diverse sample of both mothers and fathers, explicitly examined the way people *talk* about how they learned to cook.[18] Oleschuk concluded that the idea of 'cooking by our mother's side' was similarly ubiquitous in her sample, but that it was perhaps more reflective of a story people told themselves about how they had learned to cook, than actually being the main mode of acquiring cooking knowledge for everyone. Oleschuk detected diversity in her participants' learning trajectories: while many did a certain amount of foodwork with their mothers while at home, they often reported a steep learning curve after moving out of their family homes and having to take full responsibility for providing themselves with food. The strength of the 'cooking by out mother's side' idea was so marked that it often obscured people's lived experiences: participants whose immediate response was that their mothers had taught them to cook reported, after more detailed discussion of cooking over their life course, for example, learning from partners, trial and error, recipe books and cooking classes. Oleschuk raised concerns around the gendered burden imposed by this narrative: while many of the participating fathers reported interest and engagement in teaching their children to cook, the feelings of guilt, shame and anxiety around 'failing' to teach their children to cook was predominantly expressed by mothers.[18]

These divergent conclusions may reflect the different sample populations in which the studies were conducted. However, they may also represent the difficulty of retrospectively evaluating home food preparation practices from, for example, our childhoods. It is perhaps with this risk of a nostalgic outlook on food in the past in mind that Murcott noted the importance of historical data to empirically 'test' the changing practice of the family meal, citing studies using time-use diaries and historical interviews as examples.[19] The same may be said of the changing practice of foodwork, although even studies that have taken a more 'retrospective' approach to understanding foodwork in the past have found challenges to the discourses of a decline in cooking practice and skill, or of an "imagined halcyon past".[20] For example, Angela Meah's interviews with older women in the UK revealed narratives about the lack of skill and imagination in their mothers' cooking, the prevalence of overcooked vegetables, the breaches, by contemporary standards, in food safety, and the hardship of women and girls whose job it was to provision food.[20] These sorts of studies may provide rich and useful insight when they are carefully designed, as in the case of Oleschuk and Meah, to interrogate ideas about how food practices are changing over time, and their findings understood in the context of other types of data.

1.2.2 A return to the kitchen

In short, diverse pieces of evidence suggest that, broadly, from the mid-20th century onward, there has been a transition towards less time spent on the domestic domains of foodwork, and towards more time and money spent on eating out than in the past. However, the question of whether this represents a 'radical' departure, or should be viewed, negatively, as a 'crisis', remains subject to debate. After all, 83.9% of adults in the UK report that the main meal in their household is 'home-prepared' at least five days a week.[21]

Food practices have always evolved in response to changes in the food environment and domestic infrastructure, as well as being shaped by, and shaping, broader social, cultural and economic changes. Public health concern about a widespread inability to cook can be documented from at least the 19th century onward.[22] In the UK, home economics was introduced into elementary schooling during the second half of the nineteenth century due to increasing alarm about population health. This sentiment was prompted by the poor health of Anglo-Boer War recruits and high rates of infant mortality, assumed to be attributable to the ignorance of mothers.[23] Classes included cooking and food preparation, as well as other skills used in the home. A classed dimension can be seen to be at work here, with the 'lower' classes perceived as particularly lacking in skills and knowledge.[24]

Policymakers, academics, journalists and food campaigners debate the significance of our own era in the evolution of food and eating, and several scholars have noted the persistent prevalence of the discourse of decline in domestic cooking.[25–27]

Conversations surrounding changes in foodways have sometimes referenced practices, but have often focused instead on the skills that are perceived to underpin these practices. Lang and Caraher claimed that, in the UK, the pace of change has quickened since the Second World War, and cooking skills and the extent of their use are currently undergoing a phase of fundamental change. They called this a 'culinary skills transition', and suggested it was characterised by traits such as the departure of women from the home, changes in inter-generational transfer of cooking skills, increased use of technology to think about and prepare food, the withdrawal of the State from cooking skills education, and a fragmentation of food culture and food literacy.[25] In light of this transition, Lang and Caraher advocated efforts to ensure "widespread basic cooking proficiency".[25] Their argument rested on the necessity of cooking skills to healthy dietary intake, but also went beyond diet, to ideas such as empowerment and identity through food.

Trubek, on the other hand, argues that, in the United States, there are still many people who possess the skills to cook food 'from scratch', but that fast-paced, demanding contemporary life, and the resultant 'time poverty', make it difficult to do so on a daily basis.[16] This argument supports the idea of a transition in practice, but not one that is necessarily rooted in a loss of skill.

Other scholars acknowledge that, with changing economic, social and cultural contexts, food and cooking skills, and related practices, are necessarily changing, but that this should not be 'demonised': people 'today' have skills and practices that are adapted to their situations.[27,28] As Murcott asked whether the discourse around the decline of the family meal constituted a 'moral panic',[19] research on foodwork has raised concerns around the moral condemnation of foods that are not 'home-prepared',[28] or the prescriptive approach to defining 'proper' cooking.[29]

In short, opinions diverge on the current state of home food preparation: are we undergoing a 'crisis' or a 'transition'? Do these changes present real cause for concern, in health terms, or is it merely a 'moral panic'? Nevertheless, many advocate a return to the kitchen as the key to reducing diet-related disease. Ideas about the importance of cooking and cooking skills to public health have permeated the academic[30,31] and media[32–36] discourses surrounding good nutrition. These ideas also impact policy further upstream: countries such as Brazil,[37] Spain,[38] and Japan[39] have included cooking, and food and cooking skills in particular, in their dietary guidelines, while Canada's revised food guide emphasises building food-related 'skills and knowledge' in its population as a means of improving dietary quality.[40]

In determining whether this persistent call for a return to the kitchen is justified, certain questions must be addressed:

1. Is it necessary?

Are home-prepared food and domestic foodwork necessary to good diet quality, as well as to broader dimensions of wellbeing?

2. Is it feasible?

Does increasing domestic foodwork work for people in the current systems and contexts in which they exist? Are there effective ways of supporting this increase?

3. Is it fair?

Does asking people to increase domestic foodwork help to address inequality – in terms of health but also in terms of labour – or exacerbate it?

The following two sections will present an overview of the existing evidence that has sought to address these questions. First, in *Foodwork and home-prepared food: definitions, measurement and evidence*, I will focus on the work around defining and measuring the different concepts presented here (e.g. 'foodwork', 'home-prepared food', 'cooking from scratch'), which in turn underpins work on the outcomes of and barriers to these food practices, as well as evaluations of attempts to increase or alter home food preparation. Second, in *Advocating a return to the kitchen: questions surrounding feasibility, necessity and repercussions for equity*, I will outline some of the concerns that present themselves in the face of a proposed return to the kitchen.

The final section in this chapter, *Overall aims and summary of thesis chapters*, will outline the contribution this thesis makes to this body of evidence.

1.3 Foodwork and home-prepared food: definitions, measurement and evidence

1.3.1 Definition and measurement

The definitions of 'foodwork' or 'home food preparation', as well as 'home-prepared' or 'home-cooked' foods, or foods 'cooked from scratch', remain contested. Here we may already differentiate between two sets of concepts: the work involved in provisioning and preparing foods, and the foods that result from this work.

Foodwork is “the material, mental and social labor involved in meals and snacks”.[41] The distinct domains encompassed by foodwork have been outlined by several scholars. Luxton, for example, highlighted planning, shopping, setting the table, preparing foods, cooking, serving meals, clearing the table, disposing or storing of leftovers, washing dishes, putting dishes away, and cleaning kitchens.[42] Devault particularly highlighted the importance of the “invisible labour” and “intellectual activity” involved in foodwork, with household food providers engaging in a persistent, complex balancing of material, emotional and social factors.[43] These foodwork domains are echoed in Vidgen and Gallegos’ work on defining the components of ‘food literacy’: plan and manage; select; prepare; and eat.[44] These conceptualisations refer to a holistic set of food practices, and the skills and knowledge that underpin them.

If we include the “invisible labour” of foodwork referenced by Devault,[43] accessing much (or indeed all) food relies on some amount of foodwork. At the extreme, even ordering food to be home-delivered, or choosing to eat out at a restaurant, might require a certain amount of planning: scheduling these eating options into competing household timetables; fitting them within a food budget; and satisfying all those who are dining. A frozen ready meal also relies on these logistical dimensions of foodwork, as well as other material tasks like grocery shopping and washing up. However, while it could be argued that these meals require foodwork, most would not argue that they require ‘home food preparation’, or that they are ‘home-prepared’. ‘Home food preparation’, then, does not merely mean doing foodwork, but is a prescription about the sort of foodwork that must be done to create home-prepared food.

Qualitative and quantitative studies have shown that public understandings of concepts like 'cooking', 'home cooking' and 'cooking from scratch' are variable. In the United States, Wolfson and colleagues developed a survey to determine which practices American adults deemed to represent 'cooking'.[45] For most of their participants, making "something on the stove using mainly fresh or scratch ingredients" represented cooking. However, a smaller, but still substantial, proportion of participants thought that cooking did not necessarily imply the application of heat, with salads being deemed to be the result of cooking, and that cooking could include what the authors labelled convenience foods, such as pasta and store-bought sauce, instant noodles, or frozen chicken nuggets.[45] In Ireland, Lavelle and colleagues used qualitative interviews to understand their participants' understanding of cooking 'from scratch',[46] a sub-scale of Wolfson's conceptualisation of 'cooking'. Again, definitions were quite variable: some participants stated that cooking from scratch meant using raw ingredients entirely, while other suggested it could include some prepared or processed foods, such as store-bough pasta, store-bought pastry or pasta sauce in a jar.[46] Short's qualitative study of cooks living in England concluded that cooking 'from scratch' and cooking 'from pre-prepared foods' were not clearly separate sets of constructs or practices.[47] Terms that were taken for granted were found to be ambiguously defined and interpreted in many different ways by participants, and not necessarily related to the degree of pre-preparedness of the food in question.[47] Short highlights interesting examples of this:

Why did one informant consider frozen burgers as being a 'convenience' food but not a fresh sausage? […] Would it be true to say that a tin of black bean cook-in sauce from Asda or Tesco would be more likely to be considered a 'pre-prepared' food than the black bean paste from the Chinese supermarket?

While some researchers have sought to define what home cooking, home food preparation or cooking from scratch *are*, home-prepared food has also been defined by what it is not: as being the opposite, for example, of convenience food. Daniels and Glorieux present a useful classification of foods in terms of their degree of convenience (Figure 1).[48]

Figure 1 Food classification (a summary), from Daniels and Glorieux 2015

NON-CONVENIENCE	*SEMI-CONVENIENCE*	*CONVENIENCE*	
Meal ingredients		*Full (fast) meals*	
(1) Preparation meals - single meal components used for cooking from scratch (e.g. potatoes, rice, non-preserved meat)	(2) Partially-prepared and/or preserved single meal components (e.g. processed potatoes or preserved fruit)	(5) Complete fast meals (e.g. soups)	(6) Meals out (away-from-home food or restaurant expenditures)
Accessory meal ingredients			
(3) Accessory stuffs (e.g. fats and spices)	(4) Ready-made accessory stuffs (e.g. sauce)		
	(7) 'Other' (e.g. Bread, sandwich fillings, milk products and breakfast cereals)	(8) 'Ready-to-eat' snacks	

This classification highlights some of the ways in which definitions of convenience foods and home-prepared foods may be understood as, to an extent, the inverse of one another, with the 'non-convenience' foods reflecting the broadly agreed upon constructs of food cooked 'from scratch', and the 'semi-convenience' foods including some of those that were sometimes, but not always, defined as belonging to 'cooking', such as pre-prepared sauces. However, as highlighted by Jackson and Viehoff, convenience food is itself a "contested category", with "multiple and unstable meanings".[28]

Given these contested definitions, researchers have approached measuring the frequency of home food preparation or the level of consumption of home-prepared food by allowing participants to define it for themselves, simply asking participants about how often they make or eat home-prepared meals, or how much time they spend on home food preparation.[49–53] This approach has value: it avoids being overly prescriptive in defining what home-prepared food means and reflects participants' own understanding of these constructs. However, the examples given above suggest that different people may have different definitions of what home-prepared means, which may introduce bias as well as error if different groups have systematically different definitions. In the context of determining how important and necessary home-prepared food is to good dietary quality, measurement of people's dietary intake as home-prepared or not that is determined *a priori* and centred around foods and approaches to preparation seems like an important part of the puzzle.

1.3.2 Outcomes of foodwork and home-prepared food consumption

Most of the available evidence suggests that higher frequency of both cooking[49,54–60] and eating home-cooked meals[50,61] is associated with better dietary intake and improved health outcomes. Studies have also looked at time spent on home food preparation, finding that increased time spent on home food preparation was associated with improved diet quality,[53] as well as lower body mass index in women, though not in men.[62] These studies are predominantly conducted in North America and Western Europe. A longitudinal study conducted in Taiwan found that increased frequency of cooking was associated with reduced mortality risk in the study period.[49] On the other hand, a study in Japanese women found that frequency of home food preparation was not associated with increased adherence to dietary guidelines, [63] while a cross-sectional study using data from China found that increased frequency of cooking was associated with reduced odds of hypertension in women, but increased odds of hypertension in men.[64]

Studies on home-prepared food, diet and health outcomes are generally cross-sectional in design, with a few notable exceptions.[49,57,61,65] Zong and colleagues' longitudinal study in the United States found that more frequent consumption of home-prepared food was associated with a lower risk of type 2 diabetes, an association partially explained by the lesser degree of weight gain experienced by participants who frequently ate meals at home. A further study in the United States on women in midlife focused on time spent on domestic foodwork (cooking, cleaning up after a meal and washing dishes), finding that women who spent more time on foodwork were more likely to develop metabolic syndrome and have an adverse cardiometabolic risk profile.[66] The authors concluded that public health interventions should focus on cooking healthily, not just frequently.

Thus, while evidence of the impact of home food preparation and consumption on health outcomes is somewhat mixed and limited, most evidence on the association between home food preparation or home-prepared food consumption and diet quality suggests a positive relationship between the two. However, what is less clear is whether the association between home-prepared food and diet quality is attributable solely to home-prepared food, and the different foods people eat when their meals are home-prepared rather than not, or whether it is an indicator of a dietary pattern that is, broadly, healthier, or a signal of a greater commitment to eating healthily. For example, in some studies, increased frequency of eating home-prepared meals or preparing meals at home is associated with increased consumption of fruit.[50,67] While increased fruit consumption is beneficial for health, and may be reasonably interpreted as one marker of higher diet quality, fruit is more often consumed as a snack rather than as part of a meal, home-prepared or not. It may be that part of the association between home-prepared food and diet quality is not explained purely by the healthiness of home-prepared food, but also by other foods involved in a health-promoting dietary pattern which those who eat more home-prepared food may be likely to adopt.

All of these studies measure home food preparation and home-prepared food consumption in the manner described above, by asking participants how frequently they engage in these practices. A more nuanced approach was taken by Fertig and colleagues in their recent study of ethnically and socioeconomically diverse families in Minnesota.[61] At each mealtime, participants were asked to complete ecological momentary assessment survey, where they were asked to choose one or more descriptors that best characterised how the meal was prepared: "a) "fast food/take-out (eaten at home or at a restaurant);" b) "pre-prepared foods (eg, macaroni and cheese, frozen meals) or purchased snacks (eg, fruit snacks, chips, granola bars, cereal);" and/or c) "homemade/freshly prepared foods (include fresh fruits or vegetables here)."[61] The study team then classified each meal as being fully home-cooked, partly home-cooked or pre-prepared, depending on the combination of descriptors that participants had ascribed to it. This seems a better way of 'objectively' representing intake for nutritional epidemiology purposes, as people often combine foods from different sources into a single eating occasion,[28] though pre-categorising foods in this way may be less representative of how people think of meals or foodwork. This study found that fully home-cooked meals were most likely to contain fruits and vegetables, and partly home-cooked meals were most likely to contain whole grains. They concluded that interventions to increase home-cooked and partly home-cooked meals could be helpful, as could interventions to supplement pre-prepared meals with nutritious ingredients such as fruit, vegetables and whole grains.

A different approach to determining how home-prepared meal consumption might impact dietary intake and diet-related health outcomes is to analyse the nutritional content of meals and recipes. One study showed that popular ready meals came closer to meeting dietary guidelines than homemade equivalents made using recipes from television chefs (though neither the recipes nor the ready meals actually met the guidelines under study).[68] A further study reported no significant difference between the healthfulness of ready meals and meals made at home using recipes from popular online sources and cookery books,[69] though it is not clear how representative these might be of home-prepared foods that are consumed every day. Further, the extremely variable nutritional content of ready meals has also been highlighted,[70] and ready meals only represent a portion of the foods that are not home-prepared.

Studies that have examined whether the association between home-prepared food and diet quality might be different in different socioeconomic or demographic groups are limited. While a discourse of 'class pathologization', as highlighted by Hollows and Jones,[71] assumes that socially and economically excluded populations cook less often or less well, the evidence is mixed. A study in the United States found that frequency of home food preparation did not vary significantly by income bracket, nor did the frequency of cooking from scratch or using a recipe, although people living in lower income households were more likely to include packaged and boxed products, such as instant macaroni and cheese, in their diets.[72] Another study in the United States found that less educated women spent more time cooking than their more educated counterparts, though the opposite pattern was observed in men,[13] while a final American study found that households with lower income or educational attainment were more likely to cook 'never' or 'always', while wealthier households were more likely to 'sometime' cook.[73] In France, a study of socioeconomic disparity in food preparation practices found that, among women, those belonging to the 'lowest' socioeconomic categories spent the most time on home food preparation, though women in managerial occupations were more likely to prepare food ‘from scratch’.[74] Thus, evidence about the frequency with which less affluent groups prepare food at home and the time they spend is somewhat mixed, and may be different for men and women.

Meanwhile, evidence around whether home food preparation is equally beneficial for the dietary quality of all socio-demographic groups is limited. However, a study published in early 2020 did look at income-based variation in the association between self-reported frequency of cooking dinner and Healthy Eating Index score in the United States.[67] This study concluded that, while increased frequency of cooking was associated with increased diet quality for all groups, the effect size was greater for high-income participants than for low-income participants. The authors hypothesised that this may be due to the inability of low-income participants to purchase the same ingredients for use in their home food preparation as their high-income counterparts.

Increased consumption of home-prepared food has also been posited to have benefits beyond improving diet and related health outcomes, such as strengthened cultural identity, and closer relationships.[75] It has also been suggested that cooking can be a means to reduce household food expenditure and address food insecurity by allowing households to eat healthily and relatively cheaply, compared to eating out.[76] However, Rose highlighted the substantial time cost implicit in home food preparation,[77] making it a difficult strategy to adopt for households that are both time- and money-poor.

Finally, studies have also examined the association of other dimensions of foodwork with dietary intake and health outcomes. For example, a cross-sectional study conducted in France found that participants who planned their meals ahead of time had a higher diet quality and were less likely to have obesity.[78]

1.3.3 Barriers to foodwork and home-prepared food consumption

Given the evidence presented above that, on the whole, consuming home-prepared food may have benefits for diet quality, the barriers to home food preparation and home-prepared food consumption have also been investigated.

Despite concerns around a loss of culinary skill, when asked about barriers to cooking at home, only some people mention lack of skill,[79] and most people perceive their skills as being adequate.[21] Instead, the chief self-reported barriers are lack of time and money,[80–83] two forms of scarcity that interact and exacerbate each other.[84] Other barriers include past negative experiences with cooking 'from scratch',[46] and concerns about the food acceptance of children.[85]

In low-income households, participants have reported relying on pre-prepared foods as part of a strategy to avoid food waste they can ill afford: pre-prepared foods are less likely to go off than fresh ingredients, and pre-prepared foods may be more likely to be eaten by partners and children.[86] In their ethnographic work with low-income mothers in the United States, Bowen, Brenton and Elliott found that many mothers would do all the shopping for the month ahead upon receipt of their monthly income from wages and benefits.[86] This gave the mothers the reassurance that they had budgeted properly for food, that the money would not be spent elsewhere, and that their families would have enough to eat throughout the month. However, it also resulted in purchases of foods that would keep for a longer time, many of which were pre-prepared and packaged, tinned or frozen.

Finally, Trubek's ethnographic work (with informants who were, on the whole, more affluent) highlighted an important reason why people do not prepare at home: her participants enjoyed eating out and getting food home-delivered.[16] It allowed them to eat foods they enjoyed and try new dishes. This dimension of enjoyment is sometimes neglected in understanding why individuals do not always prepare meals at home, but it is important in considering how they can best be supported to eat healthily in a way that works for them.

1.3.4 Approaches to increasing home food preparation and consumption

Interventions seeking to increase home food preparation have been dominated by cooking classes. Cooking classes as a tool for dietary improvement are popular, and a wide variety of models run by governmental bodies, charities, and social enterprises proliferate in countries such as the UK, the United States, and Australia.[87–94] These interventions target a number of different demographic and socioeconomic groups and include a variety of components, deployed singly or in combination.

Though cooking classes are prevalent, systematic reviews conclude that evidence of their effectiveness in changing dietary intake is equivocal.[87–90] This may be, at least in part, attributable to a number of methodological shortcomings identified by reviews of cooking classes and their evaluations.[87–89] Interventions are highly heterogeneous in their design, and sometimes lack a clear theoretical basis. In evaluations, the means of measuring skills and behaviours in question are inconsistent, and follow-up time is short, while outcome measurement relies mainly on self-report.

Heterogeneity in intervention and evaluation design make it difficult to point to a strong body of evidence regarding what sort of cooking classes actually work, and, further, whether any cooking class is an effective means of improving dietary quality in the long-term. An attempt at identifying commonalities of more successful cooking and food skills interventions noted that interventions which included a hands-on element, as opposed to simply recipe demonstration, were more frequently successful,[95] but commented on a need for a more standardised approach in the field in order to compare and improve interventions.

While synthesising evidence surrounding the effectiveness of cooking skills interventions presents difficulties, the success of such interventions depends on adequately addressing the barriers to home food preparation. Many cookery interventions claim to address these barriers, offering recipes that are 'cheap' and 'quick', as well as, of course, 'healthy'. However, evaluations generally do not assess whether participation actually reduces the time and money spent on meals. A critical review of behavioural change techniques used in cooking skills interventions found that just under a third of interventions included in the review used the technique 'identify barriers/problem solving'.[95] It did not comment on the frequency with which these interventions successfully solved the problems in question.

Many who would like to see a population-wide increase in home food preparation have advocated doing so through school-based interventions.[31,96,97] However, as with similar programmes with adults, reviews of school-based home food preparation interventions comment on the lack of substantial evidence or rigorous evaluation in the area, making it difficult to determine how effective such interventions are and which intervention designs are most effective.[92,98] Recommendations have been made around which dimensions of such programmes might amplify the positive effects on health. These include taking a holistic approach to food education by including practical cooking classes along with nutrition education, supermarket trips, school gardens and tasting sessions; an often-cited editorial refers to teaching "hunting and gathering for the 21st century"[31]. It is also recommended that the educational component be implements as part of a 'whole school' intervention which would also tackle, for example, food served in the canteen and in on-site vending machines.[99] The extent to which such teaching is integrated into schooling varies between different countries.[100]

The use of cooking classes as a targeted strategy for individuals who are at high risk of developing diet-related disease may also be considered. Some interventions have, in a loose sense, taken this approach, running classes in communities and demographics that are assumed or have been shown to have poorer quality diets, such as people from disadvantaged communities or older men.[26] However, more targeted interventions for people with medically-recognised diet-related risks, such as pre-diabetic or diabetic individuals, might be worth investigating. Some interventions of this sort already exist, and one study that measured self-reported changes in dietary behaviour found positive results.[27]

Recipe boxes, or meal kits, which offer pre-measured ingredients for a home-cooked meal along with instructions on how to prepare it, have become increasingly popular, and have been sold as a solution to time-strapped contemporary diners who want to increase their consumption of home-prepared food.[101,102] Research on the nutritional content or impact of recipe boxes is still in its infancy. A study of commercially-available recipe boxes in Australia found them promising, providing adequate servings of core foods, and vegetables in particular, but recommended they reduce the quantity of added salt and fat, and increase the amount of fiber.[103] However, these recipe boxes are a relatively expensive way of accessing food. New interventions are being developed which offer inexpensive versions of the popular recipe boxes,[35] though at present we have little data regarding the effectiveness of these interventions in improving diet quality and health. Research to determine how meal kits are experienced by users is also limited. Trubek briefly mentions the (as yet unpublished) thesis work of one of her students, Adelaide Cummings, on the appeal of meal kits to regular users, as well as to participants who were asked to try a week of meal kits as part of the study.[16] Cummings and Trubek found that participants saw many benefits to the kits, particularly the learning of new recipes, as well as the removal of some of the burden of cooking, while still allowing participants to maintain an identity as a home cook, which was important to many. However, participants also chafed at the lack of options: there were only a few meals to choose from each week. In addition, recipe boxes raise sustainability concerns due to the substantial amount of packaging they often involve, although it has also been suggested that their pre-portioned ingredients reduce food waste.[104]

Finally, 'social' or 'community' dining deserves an honorary mention as a form of intervention that increases the consumption of food that, if not always prepared in a home, may have similar nutritional properties, and is offered at a similar (or lesser) price point, to home-prepared food. These have been advocated as an option for households and individuals looking for inexpensive, relatively healthy meals that have some of the aesthetic properties of 'home cooking', not having been industrially processed.[86] These sorts of interventions see meals prepared by volunteers for varying numbers of guests in community spaces such as leisure centres or church halls, and can have the further advantage of creating bonds within local communities. Some of these, explicitly target those who are at risk of food or housing insecurity or social isolation.[105] Research on the impact of these projects suggest they may reduce social isolation, mitigate food insecurity, alleviate chronic mental health conditions such as depression, and increase the consumption of fruit and vegetables.[105–107]

Others may target a broader swathe of the population, sometimes imposing a fee for guests, or operating as potlucks or using cooking rotas. Newer technology-based food sharing mechanisms also link people up to share food, which often takes the form of an exchange of ingredients or leftovers, but also sometimes involves a dimension of commensality.[108,109] These often have environmental sustainability and avoiding food waste as their driving principle. Less is known about the impact of initiatives like these which target the broader population and might be included in households' weekly meals alongside home food preparation and pre-prepared foods. The possibilities presented by these sorts of interventions for improving diet quality, especially in a context where many people do not feel they have the time to cook, are worth exploring.

1.3.5 Summary and use of terminology

In short, the consumption of home-prepared food has generally been measured by asking participants to self-report on the frequency with which they make or consume ‘home-prepared’ or ‘home-cooked’ meals. Evidence suggests that higher frequency of at-home meal preparation and consumption is associated with higher diet quality, though evidence of its impact on related health outcomes is scarcer and somewhat mixed.

While several studies have examined how frequency of home food preparation and different home food preparation practices vary across socio-economic groups, findings are mixed, and it seems likely that the patterns may be different for men and women. Research into socio-economic variation in the association between home-prepared food consumption and diet quality is much more limited, although the one study of which I am aware found that eating home-home prepared food was more beneficial for more affluent individuals.

While culinary deskilling has received quite a lot of the focus in terms of understanding why people might prepare meals at home less frequently than they did in the past, many studies find that a lack of time and money are among the most important barriers expressed by participants. Perhaps due to the focus on skill, home food preparation interventions have been dominated by cooking classes, though reviews suggest evaluations of these interventions are not robust enough for strong conclusions to be drawn about their effectiveness. Other approaches to increasing home food preparation have also been suggested, including food and cooking skills teaching in schools, and recipe kits.

While 'foodwork' can reasonably be defined as "the material, mental and social labor involved in meals and snacks", [41] home food preparation, and the home-prepared food that results from it, is more contested, and surveys and researchers have often left the definition open to the interpretation of their participants. In the work presented here, I recognise that foodwork involves all types of work involved in accessing foods in all types of settings, for all types of eating occasions. However, I also use 'foodwork' as a shorthand for the domains of foodwork which are captured in the data I have analysed here, namely time use diaries: in Chapter 2, this refers to time allocated to home food preparation and management, washing dishes and clearing up, while in Chapter 3, this refers to these activities as well as shopping for food. I recognise that important domains of foodwork, in particular mental and social labour, are not explicitly included in these definitions, and may not be captured in the data I use. I discuss this issue in more detail in the relevant chapters.

In referring to home food preparation, I mean a particular type of foodwork. Home food preparation involves processing ingredients in a domestic setting using methods which are habitually enquired about in studies of 'cooking', such as blending, mixing, boiling, chopping, roasting and pan frying.[81] Home food preparation also necessitates other domains of foodwork, including food shopping, clearing up and washing dishes, as well as the mental and social labour of planning and managing food for oneself or one's household. However, not all processing of food in a domestic setting is included in my definition of home food preparation, with, for example, the heating of ready meals or the combining of milk and cold cereal in a bowl being excluded. I define home-prepared food as food that results from home food preparation. Chapter 4 presents a more detailed explanation of how I operationalise these definitions in dietary survey data. While evidence that many people do not include the application of heat in their definition of cooking[45,110] has led me to prefer the term 'home food preparation', many studies use 'cooking' to refer to the same practice, and the terms are used interchangeably here.

1.4 Advocating a return to the kitchen: questions surrounding feasibility, necessity and equity

With this body of evidence on foodwork, home-prepared food consumption and health in mind, I return to the questions I posed in the first section of this chapter with regard to advocating or intervening in favour of a return to the kitchen:

1. Is it necessary?

2. Is it feasible?

3. Is it fair?

This section will highlight how far the available evidence goes, and where it stops, in answering these questions.

1.4.1 Is it necessary?

The evidence above broadly suggests that increased home food preparation and home-prepared food consumption is associated with improved diet quality, with some evidence for associated health benefits. However, this evidence does not go as far as to determine the *necessity* of home-prepared food to diet quality.

The diversification of pre-prepared foods and eating options outside the home, while often met with concern by the public health community, has also provided a number of healthy options that do not rely on home preparation.[28] It may therefore be possible to have high dietary quality, one that leads to optimal or improved health outcomes, without eating home-prepared food. At the extreme, some people may already do so, like those who live in institutions such as retirement homes or boarding schools where healthy food is provided. Indeed, many people already eat some of their meals in school or workplace canteens, or partake of 'social dining' as described above. Others may eat healthily by carefully selecting from the available out of home food options or pre-prepared foods. From this perspective, improving diet quality becomes an issue of tackling the foods that are not home-prepared – available in canteens, restaurants and supermarkets – as opposed to an issue of changing domestic food practices.

The social, cultural, and even moral aspects of 'home cooking' may go some way to explaining why it is often emphasised as the route towards a healthy diet, and why healthy dietary patterns that rely principally on foods that are not home-prepared have received less attention. Jackson and Viehoff argue that the value-laden nature of food contributes to the demonisation of convenience food by public health agencies and their strong emphasis on home cooking as a route towards improved public health, an emphasis that perhaps goes beyond what is justified by the evidence base.[28] The feelings of guilt, regret and neglect of duty associated with ready meals and takeaway food, in contrast to the high value placed on home-cooked foods, indicate a moralisation of food.[111,112] The public outcry over the 'sinner ladies' or 'junk-food mums' of Rotherham, South Yorkshire, three mothers who delivered food from local takeaways to their children as an alternative to 'healthy' lunches provided by the school, speaks to this moralisation, and to the way it intersects with notions surrounding parenting and care.[113]

Finally, the importance of home-prepared food to dimensions beyond diet quality, such as creating and maintaining cultural identity, demonstrating care to loved ones, and celebrations or rituals, must not be neglected, and may also have impacts on health, though this is beyond the scope of the studies presented in this thesis. However, it must be noted that, even among people who do not cook as much as they feel they ought to, many still invest heavily in preparing special meals for special occasions,[86] suggesting the necessary skills and repertoire to do this are still alive and well. Acknowledging that contemporary foodways incorporate some foods prepared outside the home does not mean that home food preparation will disappear. Further, where home food preparation is not desirable or feasible, families and friends still find ways to demonstrate care – even, as recently demonstrated by Warin, through convenience foods.[114]

1.4.2 Is it feasible?

Second, the feasibility of promoting an increase in the consumption of home-cooked food is dependent on negotiating the barriers to home food preparation, the extent to which people actually want to prepare food at home, in the context of the numerous other eating options noted above, and the ability of public health agencies to deliver effective interventions to support people to make this change.

The chief self-reported barriers to home food preparation are lack of time and money,[46,115,116] but further investigation may be required to fully understand what people mean by this. Some health interventions have interpreted these barriers in the most straightforward sense, that people are simply short of the few extra minutes or pounds that would allow them to prepare food at home every day, and have responded by offering, for example, cheap and quick recipes.[117] While a review of home food preparation interventions suggested that interventions that explicitly help participants to identify and address barriers (such as a lack of time or money) may be more successful,[95] only a minority of interventions did this, and the authors did not comment on different approaches to time as a barrier.

While this seems like part of the issue, feeling that we lack the time or money to cook may have other, additional meanings. As noted above, many people cook less often than they feel they should because they are worried about food going to waste if they purchase too many fresh ingredients, or if their family members refuse to eat them. Pre-prepared foods can be useful where family members have different tastes: preparing three different meals with pre-prepared components may be feasible where preparing three different meals from scratch is not. When people say they cannot afford to cook, they may also mean that they cannot afford to waste food.

With regard to time, a lack of time may represent the shortage of fifteen minutes, but it may also represent other dimensions of the experience of time, such as 'harriedness', as described by Southerton,[118] or a feeling of being overwhelmed in the face of the innumerable food options that are currently available and the de-structuration of 'traditional' food patterns. It may just mean that people have other things they would prefer to be doing with their time. Determining which of these mechanisms are at work could be useful in deciding whether quick recipes are a useful tool, or whether we must look elsewhere.

Epidemiological research into the determinants of home food preparation has often focused on the 'barriers' to home food preparation, with an implicit assumption that everyone wants to cook, but is held back from doing so. While this may be true for some, it is not necessarily true for all. In Trubek's work in the United States, as noted above, many participants enjoyed alternative ways of accessing food, such as eating in restaurants and getting food delivered.[16] This dimension seems important: some people may just not want to cook, or may only want to do it sometimes or rarely. If this is the case, then the question above, about the necessity of home-prepared food, becomes relevant: if people do not want to cook, are there other ways that they can eat healthily? Existing studies have compared the nutritional content of ready meals and home-prepared food,[68,69] as well as considering how ready meals could be tailored to address micronutrient deficiencies in elderly people who consume them frequently.[119] Meanwhile, meal replacement products such as Huel and Soylent promise to meet all nutritional requirements,[120,121] though their long-term effects on health outcomes are not known, and they may be unappealing to many people. Analyses to determine whether healthy dietary patterns that rely on little or no home-prepared food exist in the population, or what these patterns look like, have not yet been conducted.

Finally, determining whether increasing home-prepared food consumption at the population level is feasible relies on there being effective ways to support individuals to make this change. As discussed above, evidence of the effectiveness of home cooking classes lacks the robustness to draw firm conclusions as to their effectiveness, and such interventions may face issues of scalability. However, this does not necessarily mean they are ineffective, and the impact on health of holistic food education for the whole population, for example through the means of home economics teaching in schools, might be worthy of exploration, though reviews suggest that school-based interventions face some of the same issues as interventions for adults, highlighting a shortage of robust evaluation.[92,98,122] Other options, such as the recipe boxes or meal kits, may also have value, although, as noted above, research on them is as yet limited.

1.4.3 Is it fair?

Third, in advocating a return to the kitchen, its potential effect on inequality must also be considered, in terms of the labour entailed in foodwork, as well as inequalities in dietary intake and health.

When considering the repercussions of increasing home food preparation on inequality, the issue of gender cannot be ignored. Food has an impact on health, but it is also cultural, social and value-laden.[123–126] A lot of our interactions with food, particularly in our early years, happen in the home, and the responsibility for teaching young people how to eat well is seen as being much more the domain of parents, and especially of mothers,[126–128] than the responsibility for teaching other skills.[127,129,130] The social, cultural and even moral nature of food impacts how we intervene to improve diet, particularly when it comes to interventions aiming to promote the consumption of home-cooked food.

Some have argued that promoting the consumption of home-cooked food is conservative and regressive, and tantamount, in heterosexual couples at least, to telling women to get back in the kitchen.[127] This argument is not without substance: eating more home-cooked food means someone has to do more cooking, and, though some progress has been made, women still do the lion's share of unpaid domestic labour.[131] More home-cooked food *without* putting women back in the kitchen would mean adjusting some other variable, such as getting men to cook more, making cooking faster, or finding ways of industrialising more of the food processing while minimising the impact on the nutritional content or aesthetic and symbolic value of the food. Here, home economics teaching could also be part of the answer, by moving the responsibility for teaching food and cooking skills away from the home, where it broadly falls to mothers.

In addition, the repercussions of advocating a return to the kitchen for socioeconomic inequality must be considered. As noted above, it is broadly assumed that socially and economically excluded populations cook less often or less 'well',[71] despite inconsistent and limited evidence. On the other hand, socioeconomic inequalities in dietary intake and related health outcomes are well established in the epidemiological literature. Determining whether focusing on home food preparation is important to mitigating these inequalities in diet quality is a necessary step. Further, with regard to a lack of time as a barrier to home food preparation, this may be exacerbated among those who both lack time and are on lower incomes. Existing research suggests those who are more ‘time-poor’ (but ‘money-rich’) may buy their way out of certain kinds of unpaid labour,[132,133] which could include foodwork, for example going out to eat at a restaurant. However, this may not be an option in households where time poverty and income poverty coexist.

Finally, with regard to low-income or food insecure households, advocating home food preparation as a means to meet dietary guidelines while spending little on food, a stance which is sometime taken explicitly in public policy, as in the United States with the ‘Thrifty Food Plan’,[134] but also more implicitly, through public or media discourse, as in the UK,[135,136] risks unfairly centring the systemic problem of food poverty around an individual behaviour.

1.5 Overall aims and summary of thesis chapters

As has been noted, the questions that remain in the study of foodwork, home food preparation and health are numerous, as are the unsolved problems in the public health application of the evidence. This thesis aims to present a social epidemiology of foodwork and home-prepared food consumption, using nationally representative data from UK adults to:

1) Investigate how a ‘lack’ of time, in the form of competing demands on and other uses for time, is associated with time allocated to foodwork; and
2) Explore the association between home-prepared food consumption and diet quality.

Chapter 2 will map foodwork over time, using three cross-sectional time use surveys from 1983 and 2014, and place it in the context of other daily activities to determine how participation in and time spent on foodwork has changed over this period alongside other demands on and uses of time. Chapter 3 will focus on the most recent UK Time Use Survey (2014-15) and determine whether and how daily time use varies between people who do more or less foodwork. These two chapters will offer insight into a lack of time as a barrier to home food preparation.

Chapter 4 will move from foodwork to home-prepared food itself, presenting a measure of home-prepared food consumption based on detailed food diaries collected as part of the National Diet and Nutrition Survey, and seeing how this measure compares to a more conventional measure: self-reported frequency of home food preparation in participants' household. Chapter 5 will use the food diary-based measure to determine the role home-prepared food plays in contemporary diets: its energetic contribution, its association with diet quality, and variation in these between different socioeconomic and demographic groups. Chapter 6 will use the same measure to answer the question: is it possible to eat healthily while consuming limited home-prepared food?

Finally, Chapter 7 will discuss the findings of the studies as a whole, and the contribution they make to answering the questions surrounding the necessity, feasibility and equity of advocating for home food preparation, and intervening in home food preparation practices.

A note on presentation

Throughout these chapters, bold font in tables indicates a statistically significant result relative to the critical threshold designated in the text for that particular study or analysis.

The empirical chapters included in this thesis are either in preparation for submission to a journal (Chapters 2, 3 and 4), or have been published (Chapters 5 and 6), as individual manuscripts. As a result, they are designed to stand alone with regard to the explanation of their methods. There are two exceptions to this in the thesis: the introduction to compositional data in Chapter 2 (2.3.1 Understanding compositional data) and the description of my approach to estimating proportion of energy from home-prepared food in Chapter 4 (4.3.3 Consumption of energy from home-prepared foods). For the sake of brevity, these sections are not repeated, and have instead been referenced where relevant in later chapters.

2 Foodwork in the United Kingdom from 1983 to 2014

This study was presented as Clifford Astbury C, Penney TL, Adams J. *Time and foodwork in the UK: analysis of UK Time Use Surveys 1983-2014*. Cook and Health Network Annual Conference, October 2019.

2.1 Abstract

Background: While foodwork (tasks required to access food, including home food preparation) in the UK declined toward the end of the 20th century, it is not known whether this trend has continued into the 21st century. Further, evidence suggests many people feel they lack the time to cook, and it is not known whether this is attributable to increasing demands on their time.

Methods: Analysis of repeat cross-sectional data from three UK time use surveys: 1983, 2000 and 2014; participants aged 19 and over (N=14,810). Changes in participation across survey years were analysed using linear regression, and interaction terms were added to determine whether trends varied between different socio-demographic groups. Among participants who did foodwork, time use over 24 hours was categorised into eight parts, forming a composition: (1) personal care; (2) sleep; (3) eating; (4) physical activity; (5) leisure screen time; (6) work (paid and unpaid); (7) socialising and hobbies; and (8) foodwork. I used compositional multivariate analysis of variance to test whether the time-use composition

varied across survey years. Linear regression models and bootstrap confidence intervals were used to determine which of the activities varied between survey years. I tested for interactions with socio-demographic characteristics, performing stratified analyses where appropriate.

Results: Participation in foodwork, daily foodwork episodes and time allocated to foodwork declined significantly between 1983 and 2014. However, a concurrent increase in time spent on work was not observed. Instead, time spent on sleep and screen time increased significantly. The trend was variable across population sub-groups, with the decline in foodwork being significant among women but not among men.

Conclusion: While many people in the UK continue to allocate time to foodwork on a daily basis, foodwork has continued to decline into the 21th century, though there was no concurrent increase in time being allocated to work, suggesting external and non-discretionary demands on time have not increased. Practitioners seeking to address a lack of time as a barrier to foodwork may wish to accommodate a broad definition of what this could mean, and tailor their interventions to ensure they are providing adequate support for people to eat healthily, as well as ensuring they explicitly address issues of gender equity.

2.2 Introduction

As described in Chapter 1, observational evidence suggests that higher frequency of both making[49,54–57] and eating[49,50,137] home-prepared meals is associated with better dietary intake. Home-prepared meals rely on time spent on home food preparation, as well as a number of other domains of foodwork, including clearing up, washing dishes, shopping, planning and management.

Time is an important dimension of home food preparation, and increased time spent on home food preparation, washing dishes and clearing up (hereafter 'foodwork') has been shown to positively impact the resultant diet quality.[138] While the proportion of foodwork that is allocated to home food preparation may be somewhat variable, it can be assumed that, in many cases, more time allocated to foodwork also represents more time allocated to home food preparation, and therefore more home-prepared food is being produced. First, more time spent on foodwork may represent a higher frequency of preparing meals at home. Second, more time spent on foodwork may represent a particular kind of home food preparation, preparing food 'from scratch',[83] or from unprocessed or minimally processed ingredients, which has been posited to be particularly important to achieving high diet quality.[139] However, it must be noted that many people eat home-prepared meals while doing none or only some of the necessary foodwork themselves, as when one person in a household is responsible for putting meals on the table for the whole household.

Beyond its potential association with diet quality, time is an important dimension in understanding home food preparation due to the frequency with which a lack of time is cited as a barrier to this practice, and the importance of time and convenience in structuring food practices and attitudes towards them.[140] Studies based on quantitative surveys, interviews and ethnographic work show that participants prepare food at home less often than they would like because they feel they lack the time to do so.[80,82,83,141–144]

It has been hypothesized that people living in the United Kingdom (and around the world) feel more rushed than past generations, a phenomenon variously referred to as time squeeze, time famine, the 'speed-up' or '24/7' society, or social acceleration.[145,146] However, it is not clear that the subjective experience of rushedness is truly increasing. In the UK, the number of people who reported usually feeling 'pressed for time' did not increase between 1985 and 1992,[118] and there was no increase in self-rated feelings of rushedness between 2000 and 2015.[145] Nevertheless, the idea of a lack of time as being characteristic of contemporary existence is powerful.

Meanwhile, studies conducted in a number of high-income countries suggest that, at least until the beginning of the 21st century, time spent on foodwork decreased.[12,147,148] In the UK, time spent on home food preparation, clearing up and washing dishes decreased in one study by 16 minutes between 1975 and 2000, although participation in the task increased, from 75% to 83% of the sample, driven principally by the increased number of men engaging in home food preparation.[10] However, it was not clear whether the decrease in time spent was for the whole sample or only among participants who had engaged in foodwork, making it difficult to determine whether this represented a decrease in foodwork across the whole population or a redistribution of responsibility. The authors also examined the practice of eating more broadly over the same period, claiming that this period had seen a transition from more domestic to more commercial modes of food provisioning. This was reflected in their analysis of time spent eating in different locations, which showed that time spent eating out of home increased while time spent eating at home as well as at friends' or relatives' houses decreased, as well as in their analysis of time spent on foodwork.

The authors note that this claim is supported by evidence from household food expenditure data, which suggests that a greater proportion of food spending was allocated to food prepared outside the home in 1999 than in 1975.[14] In 1975, spending on groceries was around 6 times greater than spending on takeaways and restaurant meals, while in 1999 it was less than 2.5 times greater.[14] However, it is not clear that this trend has continued, with spending on groceries in the United Kingdom remaining around 2.5 times greater than spending on out of home food in 2017,[149] though it must be noted that household spending data may obscure some changes in household food practices, with supermarket purchases including many pre-prepared meals and foods, as well as being influenced by changes in the relative cost of home-prepared and out of home food.

The picture of home food preparation and its attendant tasks – hereafter ‘foodwork’ – in the 21st century is less clear. In the United States, trends in foodwork appear to be changing: after a decrease in foodwork in the second half of the 20th century, foodwork increased between 2003 and 2016, with most groups showing an increase in both participation and time spent.[13] Nevertheless, inequalities persisted in the allocation of this labour, with women, and less educated women in particular, doing substantially more foodwork than other groups. No studies have been published that analyse how foodwork has evolved over the past two decades in other countries.

The hypothesised phenomenon of time squeeze, paired with the decrease in time spent on foodwork, might lead us to infer that the former has led to the latter, but evidence on the topic is lacking. Increasing external demands on time in the form of paid or unpaid labour may have a role to play. However, over the same period of time, a number of other relevant drivers of food practices and time use have also undergone substantial changes which may have been more instrumental to the decrease in time spent on foodwork. Gershuny and Sullivan propose that changes in time allocation reveal the changing material constraints which might lead social groups to organise their practices differently, as well as how social norms may be changing.[150] A variety of changes to both material constraints and social norms may be driving changes in food practices, such as changing ideas about gendered responsibility for foodwork, increasing cultural normalisation of eating outside the home, or a diversification of the food products and outlets available. Understanding these drivers is important to identifying effective interventions to support people to eat more healthily.

Compositional data analysis is a technique that has recently been applied to the study of time allocated to health behaviours such as physical activity.[151–153] This approach construes a 24-hour hour time budget as a composition made up of different activities, or parts, and takes into account some key properties of time: that time is bounded, and that time spent on one activity necessarily involves a trade-off with other activities. While compositional data analysis has been applied in the field of nutrition to explore the nutritional composition of diets,[154] it has not yet been applied to time spent on food practices in the context of other daily activities. While advocates of the compositional data analysis approach have argued that data on time use is inherently compositional, and that it should always be analysed as such,[155,156] it seems reasonable to use more conventional statistical methods when only looking at one portion of time use, such as foodwork, as previous studies have done. However, the compositional approach has the advantage of allowing me to examine daily time use as a whole. Where more or less time is allocated to foodwork in different years, we can see how that time is being spent instead.

Thus, using nationally representative data on time use between 1983 and 2014 in adults living in the UK, the aims of this study were:

1. To describe trends in participation in foodwork, and verify whether these trends were different in different socio-demographic groups; and
2. To describe trends in time allocated to foodwork among participants who did foodwork, placing foodwork in the context of other activities, and verify whether these trends were different in different socio-demographic groups.

2.3 Methods

2.3.1 Understanding compositional data

A number of useful articles discuss the properties of compositional data and how they should be analysed,[152,155–159] and Foley et al. provide an overview of the compositional data analysis paradigm in health research.[151] Briefly, compositional data are made up of mutually exclusive parts which sum to a whole, such as 100% or, in this case, 24 hours.[157] Transforming time-use data into a composition requires classifying time spent into different categories, with each category representing a part of the composition.

There are numerous approaches to classifying time-use.[160] Health researchers have sometimes classified time-use based on metabolic intensity, separating the minutes of the day into time spent sleeping, being sedentary, and engaging in light, moderate or vigorous physical activity. Other researchers, in health research as well as in economics and sociology, have characterised parts as activity sets, for example, the 'obligation' to spend time on certain activities, such as childcare or paid work. This is often called non-discretionary time, while discretionary time represents time spent on leisure activities. Other researchers may be interested in, for example, the division of labour within households, and further break down non-discretionary time into paid work and unpaid work.

Compositional information is relative rather than absolute, with ratios between parts being the primary interest as opposed to the absolute values taken by parts. Compositional data analysis has the advantage of being congruent with the co-dependent nature of compositional data. A common approach is to transform and express compositions as log-ratio coordinates. Expressed in this form, compositions may be treated as either exposures or outcomes in statistical models. Coordinates may then be back transformed into original units for interpretation.

Because log-ratio coordinates may not be applied to zero values, the presence of zero values in one or more parts of a composition prohibits the use of compositional data analysis. Zeros in compositional data may be theorised as either 'rounded', representing a small non-zero value that falls below some detection limit, or 'essential', meaning a true zero and representing the complete absence of that part in the composition. Rounded zeros have been dealt with by imputing small non-zero values to replace them, but essential zeros remain a core challenge for compositional data analysis.[161] Often, where there are a large number of zeros in one part, that part is amalgamated with other parts to address the problem. As a result, analysing data as a composition imposes limits on which types of time-use may be examined in isolation.

2.3.2 Data source

This study presents a secondary analysis of three cross-sectional national surveys of UK residents: the ESRC Time Budget Survey 1983-84, the National Survey of Time Use 2000-01 and the UK Time Use Survey 2014-15 (hereafter referred to as 1983, 2000 and 2014). These surveys were harmonised as part of the Multinational Time Use Study (MTUS),[162,163] and the data was obtained from the MTUS Extract Builder Database.[164] The survey characteristics are described in Table 1.

Table 1 Survey characteristics

Year	Age	Sample size (individuals)[a]	Survey period (months)	Individual response rate (%)	Diary days	Time intervals	Hour coverage
1983	14+	1,601	2	51.0	7	15 min	04:00-03:59
2000	8+	10,573	15	45.0	2	10 min	04:00-03:59
2014	8+	8,274	23	45.0	2	10 min	04:00-03:59

[a]Number of productive participants of any age in each sample, i.e. individuals who produced at least one valid diary day

All three surveys recruited participants by randomly sampling private addresses from postcode sectors across the UK. In each eligible household (where ineligible households included non-residential addresses, holiday homes and vacant buildings), one individual was asked to complete a household demographic questionnaire. Following this, all eligible individuals (i.e. participants within the right age range) in included households were asked to complete an individual demographic questionnaire and, depending on the survey year, two or seven time-use diary days (one weekday and one weekend day, or a full week). Diary days started at 4 am and covered a full 24-hour period. This period was divided into 10- or 15-minute time intervals, and participants were asked to fill in a primary activity for each time interval. Participants also recorded their location for each time interval and had the possibility of recording up to two or three secondary activities, although only primary activities were examined in this analysis. All responses were given in free text, and the diaries were coded by the study team using a activity codes determined a priori.

2.3.3 Exclusion criteria

A series of quality checks suggested by the MTUS study team were applied to diary days, where diary days characterised by too many ‘flags’ indicating poor quality were excluded. These flags were: having more than 90 minutes of missing time, reporting fewer than seven episodes of activity (i.e. seven changes between activity or location), and missing two or more of four basic activities (sleeping/resting, eating/drinking, personal care and exercise/travel).[59] Diary days having all three of these flags were excluded. I further excluded any diary days that did not report a full 24 hours of eligible activity codes (i.e. where at least one time interval had been coded as, for example, ‘unspecified time use’ or ‘illegible activity’), as this would prevent the diary from being interpreted as compositional data. Finally, diary days reporting zero minutes spent on sleep were also excluded as being extremely atypical representations of the 24-hour time slot.

Of the participants who had provided at least one diary day that met both general and study-specific quality checks, I excluded all participants who were less than 19 years old at the time of data collection.

I selected one diary day for each remaining participant. For the 1983 survey, where participants completed up to 7 diary days, I first randomly selected one weekday and one weekend day, and then randomly selected one of these days. For the 2000 and 2014 surveys, I randomly selected one diary day. In some cases, participants had only provided one diary day (or, in the case of the 1983 survey, only weekdays) that met all of the quality checks described above. As long as participants provided at least one valid diary day, this diary day was included in this analysis.

2.3.4 Definition of exposure (survey year)

I used survey year as a categorical variable with three categories: 1983, 2000 and 2014.

2.3.5 Definition of outcomes

2.3.5.1 Engagement in foodwork

I defined engagement in foodwork as a binary variable, with participants who reported spending any time on foodwork (time coded as ‘food preparation/cooking’ or ‘set table, wash or put away dishes’) being classified as engaging in foodwork, and participants who reported no time spent on foodwork being classified as not engaging in foodwork.

2.3.5.2 Time-use composition

As described above (2.3.1 Understanding compositional data), compositional data are made up of mutually exclusive parts which sum to a whole, such as 100% or, in this case, 24 hours.[157] Transforming time-use data into a composition requires classifying time spent into different categories, with each category representing a part of the composition.

I partitioned each participant’s time-use diary into eight mutually exclusive parts based on the primary activity they had reported in each time slot:

1. Personal care (e.g. showering, grooming)
2. Sleep
3. Eating
4. Physical activity (including walking)
5. Leisure screen time

6. Work (including paid work as well as unpaid domestic work such as housework, caring and shopping, but excluding foodwork)
7. Socialising and hobbies not captured elsewhere
8. Foodwork (home food preparation, clearing up after meals, washing dishes)

The specific activities included in each part are described in Appendix 1.

All participant time could be allocated to one of these parts. Time spent travelling was allocated to the activity it enabled, with the exception of time spent on active travel (coded as either walking/on foot, or by bicycle), which was coded as physical activity. For example, time spent travelling (e.g. by bus) to a workplace or to drop children off at school was allocated to work, while time spent travelling (e.g. by car) to a friend's house for dinner became part of time spent socialising. The same travel by foot or other physical transport would be allocated to physical activity.

Our primary interest in this time-use composition was time allocated to foodwork, but I also explored other activities, allowing me to determine, where more or less time was allocated to foodwork in different years, how that time was being allocated instead.

Due to the impossibility of including zero values in compositional data described above, for this analysis I treated zeros as rounded, replacing zeros with small values under 10 minutes by drawing time from other parts using a log-ratio data augmentation algorithm. my parts were defined in such a way that it seemed likely that most participants would spend at least a small amount of time engaging in each of the groups of activities. Because participants were asked to record their activities in blocks of 10 or 15 minutes, I assumed that some activities would not take enough time or have enough perceived importance to be recorded but would nevertheless occur between other activities recorded throughout the day. As a result, a participant who had recorded no time spent on physical activity on a diary day may still have walked around their house or to their car.

2.3.6 Covariates

Covariates were self-reported in the individual demographic questionnaire and were age, gender, economic activity (as defined by the Office for National Statistics: economically active, i.e. in paid employment or actively seeking work, or economically inactive[1]), highest level of education completed (less than secondary, secondary, or above secondary), and household structure (no children under the age of 12 in the household, children with one parent or guardian, or children with two or more parents or guardians), as well as diary day type (weekend day or weekday) for the selected day.

2.3.7 Analysis

I described the socio-demographic characteristics of the sample in each survey year. I further described the proportion of participants reporting engaging in foodwork in each sample year, as well as the number of episodes (i.e. separate daily occurrences) of foodwork, for the whole sample. I conducted chi-square tests to determine whether, in a given survey year, participants from different population sub-groups were significantly over- or under-represented among those who engaged in foodwork, and a Kruskal-Wallis test to determine whether number of foodwork episodes varied significantly between different survey years.

I then used a logistic regression, adjusted for covariates, to determine whether the likelihood of engaging in foodwork had changed over the years. I introduced interaction terms to determine whether this association varied by age, gender, economic activity, age at leaving full-time education, household structure or diary day type. Where interaction terms were statistically significant, I performed a stratified logistic regression to determine the odds of engaging in foodwork across different survey years for different population sub-groups. The weights provided by the MTUS study team were applied in these analyses.

I described the patterns of zero values in the time-use composition. All subsequent analyses were performed on the imputed compositions, where zero values had been replaced by small non-zero values, drawing time from other parts.

In order to test for differences in mean time-use composition between different survey years, I followed the procedure suggested by Martìn-Fernandez and colleagues in their paper on interpreting differences between groups of compositional data.[52]

First, I used a compositional multivariate analysis of variance (MANOVA) to determine whether participants in the three survey years differed.

Second, if the results of the MANOVA suggested rejecting the null hypothesis of equality of means between the three groups of compositions, I used a Hotelling's *T*-squared test, the multivariate generalisation of a standard *t*-test, to determine which pair of survey years – 1983 and 2000, and 2000 and 2014, and 1983 and 2014 – were different after adjustment for covariates.[52]

Third, where differences between two particular years were detected, I estimated compositional means adjusted for covariates for each time-use part (i.e. activity set) in each year. To do so, I transformed the compositional data using an isometric log-ratio (ilr) transformation. This transformation produces a set of ilr coordinates numbering one fewer than the number of parts.[52] In this eight-part composition, seven ilr coordinates were produced, taking the form of a ratio between one part and another part or parts.

Linear regression models were created with the ilr coordinates as outcome variables and the survey year as the exposure, along with the other covariates. For each survey year, I estimated the adjusted mean ilr coordinate value for each of the seven ilr coordinates. I then back-transformed these ilr coordinate estimates to obtain the model-adjusted compositional means of time spent in each of the eight parts for participants from each of the three survey years.

Finally, I calculated the log-ratio differences in adjusted compositional mean between the pairs of survey years. Log-ratio differences are log-transformed ratios, where the numerator is the model-adjusted minutes per day spent on a given part in a given group of participants, and the denominator is the model-adjusted minutes per day spent on the same part in another group of participants. For example, this could be the model-adjusted time spent sleeping in participants from the 2000 survey compared to the model-adjusted time spent sleeping in participants from the 1983 survey. In order to determine whether the difference in time spent was significant at the critical level, I constructed confidence intervals for each part using a bootstrap technique.[52] Confidence intervals that crossed zero indicated that there was no between-group difference for this part.

I performed the above analysis for participants who engaged in foodwork, as well as, separately, for participants who did not engage in foodwork, allowing me to descriptively compare the time-use compositions for both groups of participants.

In order to determine whether these associations were different across different population sub-groups, I entered interaction terms into the Hoteling's *T*-squared models to determine whether the relationship between year and time-use composition differed by gender, economic activity, education level, or household structure. Where the interaction term was significant, I stratified the sample and performed the analysis again for each subgroup, estimating the model-adjusted compositional mean time spent in each part, and calculating the log-ratio differences and confidence intervals for each part in, for example, men and women separately.

For this analysis I used the open source software R (www.r-project.org) and a number of bespoke packages for the analysis of compositional data, including Hotelling, lsmeans, Compositions, zCompositions, and robCompositions. Throughout this analysis I adjusted the critical level (0.05) in proportion to the number of groups analysed using the Bonferroni correction in order to prevent the artificial increase of the Type I error rate, as suggested by Martìn-Fernandez and colleagues.[52] This resulted in a critical level of 0.017, which I used for all analyses.

Due to the relative nature of compositional information, applying weights to compositional data in the conventional way, as a multiplicative factor, is not feasible. In order to make these estimates population representative, I instead used the weights provided by MTUS as sampling probabilities, using a bootstrap technique to resample a weighted sample from the 'real' sample.

2.4 Results

2.4.1 Sample characteristics

The full data set provided by the MTUS team for the UK sample in 1983, 2000 and 2014 consisted of 47,873 time-use diary days from 20,327 participants. Of these, 41 diary days failed the general quality checks recommended by the study team, and 14,186 diary days failed the quality checks specific to this analysis (13,299 reporting less than 24 h and 887 reporting no sleep). Of the remaining 33,646 valid diary days, 4,484 were filled out by those aged under 19 years. After applying all of these exclusion criteria, I randomly selected one diary day from each participant, creating an analytic sample of 14,810 diary days from 14,810 participants. Of these, 11,491 participants had engaged in foodwork.

Table 2 describes the characteristics of the analytic sample and shows some substantial differences in the samples across survey years. The over-representation of women, particularly in 1983, represents an artefact of individual non-response, while the substantially higher levels of educational attainment in later survey years may more likely be explained by a population-level change that occurred in the UK over this period.[165] Further, weekday diary days are over-represented in the 1983 sample. While I attempted to minimise the effect of the difference in diary styles (7-day diaries versus 2-day diaries) across survey years (see 2.3.3 Exclusion criteria), weekdays remain over-represented, particularly in 1983, because some participants only completed weekday diaries (where they completed fewer than seven days or non-consecutive days), while other participants only completed diaries that passed the quality checks on weekdays. Sample weights have been applied to further analyses, and day type has also been adjusted for, along with other covariates, in order to mitigate these discrepancies.

Table 2 Sample characteristics (n = 14,810, unweighted)

Characteristic	Survey year		
	1983	2000	2014
n	1229	7697	5884
Age (mean (SD))	45.06 (17.11)	46.07 (16.49)	479.34 (17.44)
	n (% of survey year sample)		
Gender			
Male	491 (39.95)	3558 (46.23)	2790 (47.42)
Female	738 (60.05)	4139 (53.77)	3094 (52.58)
Economic activity			
Economically active	739 (60.13)	4997 (67.58)	3901 (66.50)
Economically inactive	490 (39.87)	2397 (32.42)	1965 (33.50)
Household type			
No children in household	896 (72.90)	5466 (71.01)	4379 (74.42)
Single parent	25 (2.03)	275 (3.57)	192 (3.26)
Dual parent	308 (25.06)	1956 (25.41)	1313 (22.31)
Education			
Less than secondary	789 (65.26)	2936 (39.71)	237 (4.81)
Completed secondary	190 (15.72)	2530 (34.22)	1582 (32.13)
Above secondary	230 (19.02)	1928 (26.08)	3105 (63.06)

Diary day			
Weekday	749 (60.94)	3972 (51.60)	2949 (50.12)
Weekend	480 (39.06)	3725 (48.40)	2935 (49.88)

2.4.2 Participation in foodwork

Table 3 shows the proportion of participants who engaged in foodwork in each survey year, for the whole sample and for different population sub-groups, as well as the number of episodes of foodwork among those who engaged in it. As these results are weighted, proportions are presented instead of absolute values. Table 3 also shows the results of chi square tests to determine whether, in a given survey year, population sub-groups were significantly under- or over-represented.

Table 4 presents the results of adjusted logistic regression models of the odds of participating in foodwork in different survey years for the whole sample and stratified by gender, economic activity and household structure. These were performed where significant interaction terms ($p<0.017$) suggested that the odds of participating in foodwork had changed differently in different socio-demographic groups. Interaction terms for age, education level, and diary day were non-significant.

Overall, participation in foodwork decreased significantly over the period, from 81% of the population reporting any foodwork in 1983, to 80% in 2000, to 74% in 2014. The median number of episodes of foodwork per day among participants who did foodwork decreased significantly from 3 in 1983 to 2 in 2014.

While, compared to men, a larger proportion of women continue to engage in foodwork, the odds of women participating in foodwork decreased significantly between 2000 and 2014, whereas the odds of men participating did not.

A larger proportion of economically inactive participants engaged in foodwork than economically active participants. Although the odds of participating decreased significantly in both groups between 2000 and 2014, they decreased more substantially among the economically inactive.

Meanwhile, a larger proportion of participants living in single parent households engaged in foodwork than those living in dual parent households or households without children. The odds of engaging in foodwork did not decrease among participants living in households with children, as it did in those living in households without children.

Finally, a smaller proportion of participants with a secondary education engaged in foodwork than those who had either more or fewer qualifications, although changes in participation across survey years were not significantly different across education levels.

All subsequent analyses were performed on the imputed compositions, where zero values were replaced with small non-zero values as described in the methods. Patterns of zeros in the time-use composition are reported in Appendix 1.

Table 3 Participant engagement in foodwork by survey year (n=14,810, weighted using MTUS weights)

	Proportion of group engaging with foodwork (%)								
	1983	Pearson χ^2	p value	2000	Pearson χ^2	p value	2014	Pearson χ^2	p value
Total	80.68			79.72			73.78		
Gender									
Male	64.99	117.25	<0.001	69.81	375.05	<0.001	63.88	200.64	<0.001
Female	90.96			89.09			82.73		
Economic activity									
Economically active	72.80	67.77	<0.001	74.95	169.57	<0.001	69.04	138.32	<0.001
Economically inactive	92.51			89.50			83.38		
Household type									
No children in household	80.11	0.33	0.72	80.54	13.38	<0.001	73.38	6.53	<0.002
Single parent	82.94			88.91			86.43		

Dual parent	82.18			76.07			73.19		
Education									
Less than secondary	81.88			82.79			78.79		
Completed secondary	74.79	2.38	0.10	77.47	11.28	<0.001	71.23	4.69	<0.01
Above secondary	81.58			78.34			75.35		
Diary day									
Weekday	80.92	0.06	0.80	80.73	4.44	0.04	74.99	3.36	0.07
Weekend	80.32			78.59			72.56		
Age of those engaging in foodwork (years (mean (SD)))	45.1 (16.5)			46.8 (16.7)			49.3 (17.8)		
Foodwork episodes (for those who engaged)								χ^2	p value
Median (IQR)	3 (2,5)			3 (2,5)			2 (1,4)	7015.60	<0.001

Table 4 Logistic regression of foodwork participation over survey years (n=14,810, weighted using MTUS weights)

	Adjusted logistic regression[a]				
	1983	2000		2014	
		OR	98.3% CI	OR	98.3% CI
Total	Reference year	1.00	0.81, 1.23	0.65	0.52, 0.82
Gender					
Male		1.19	0.91, 1.55	0.83	0..62, 1.10
Female		0.84	0.58, 1.21	0.50	0.33, 0.76
Economic activity					
Economically active		1.09	0.86, 1.39	0.71	0.55, 0.92
Economically inactive		0.81	0.51, 1.30	0.53	0.31, 0.89
Household type					
No children in household		1.08	0.85, 1.38	0.65	0.50, 0.85
Single parent		2.63	0.46, 14.93	2.81	0.43, 18.53

Dual parent		0.81	0.53, 1.22	0.64	0.41, 1.02
Education					
Less than secondary					
Completed secondary	N.S. interaction term				
Above secondary					
Diary day					
Weekday	N.S. interaction term				
Weekend					
Age	N.S. interaction term				

[a]Adjusted for all covariates (age, gender, economic activity, education, household type and diary day type), except stratifying variable for stratified regression

2.4.3 Differences between time-use compositions across survey years

After adjusting for covariates, the compositional MANOVA suggested there was a statistically significant difference in time-use composition between 1983, 2000 and 2014 ($p<0.001$). The Hotelling's T-squared test further suggested there was a statistically significant difference in time-use composition between all pairs of survey years: 2000 and 1983, 2014 and 2000, and 2014 and 1983. It was therefore necessary to analyse differences in each activity set, or part, between all survey years.

2.4.4 Trends in time allocated to foodwork and other activities across survey years

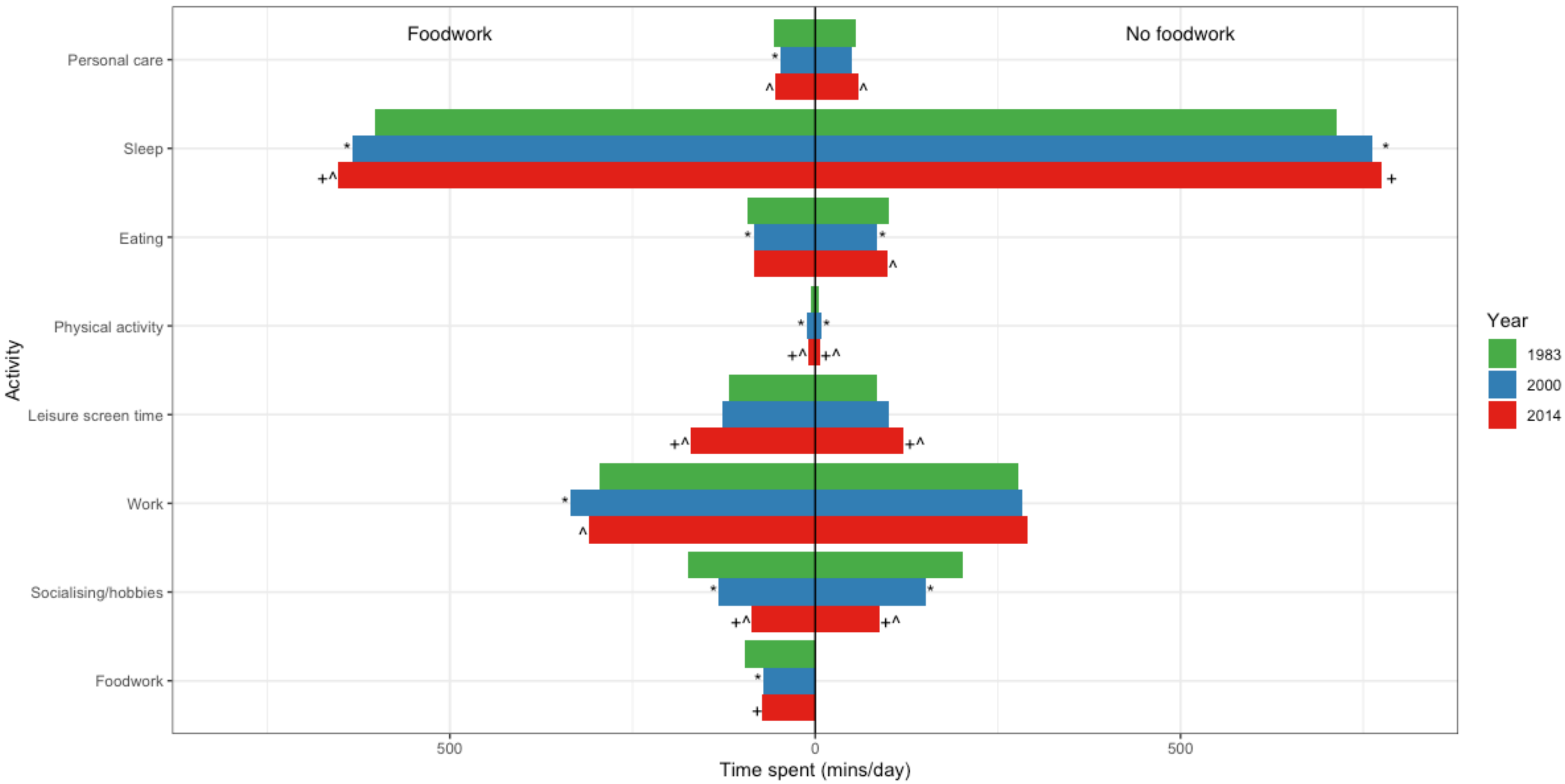
The model-adjusted compositional means for each part for 1983, 2000 and 2014, presented separately for participants who reported engaging in foodwork and those who did not, are shown in Figure 2. Symbols indicate a statistically significant log-ratio difference between survey years for each part ($p<0.017$).

The numerical values underlying Figures 2, 3, 4 and 5 are in Appendix 1.

Among participants who engaged in foodwork, time spent on foodwork decreased significantly overall, due principally to a decrease of around 25 minutes between 1983 and 2000. While foodwork decreased, between 1983 and 2000, time spent on work increased significantly by 39 minutes. However, where work then decreased significantly between 2000 and 2014 (by 24 minutes), there was no increase in time allocated to foodwork over this period. Instead, over the same period, time spent on sleep and leisure screen time increased.

In some dimensions, participants who did not do foodwork allocated their time differently than those who did foodwork, spending more time on sleep and less time on work across all survey years. Further, where participants who did foodwork allocated significantly more time to work between 1983 and 2000, the same period where their time allocated to foodwork decreased significantly, participants who did not do foodwork did not significantly increase their time allocated to work. Finally, participants who did not do foodwork increased their time allocated to eating between 2000 and 2014, while participants who did foodwork did not.

Figure 2 Model-adjusted[a] compositional means of time spent for the whole sample, by engagement with foodwork (n=14,810)



[a] Adjusted for age, gender, economic activity, education, household type and diary day type

+ Statistically significant log-ratio difference between 2014 and 1983 for this part

^ Statistically significant log-ratio difference between 2014 and 2000 for this part

*Statistically significant log-ratio difference between 2000 and 1983 for this part

2.4.5 Effect modification

Gender, economic activity and education level were all significant modifiers of the association between year and time-use composition ($p<0.001$) among participants who engaged in foodwork, while household type was not. Figures 3, 4 and 5 present the model-adjusted compositional means for participants who engaged in foodwork for each part for 1983, 2000 and 2014, stratified by gender, economic activity and education, respectively. Symbols indicate a statistically significant log-ratio difference between survey years for each part ($p<0.017$).

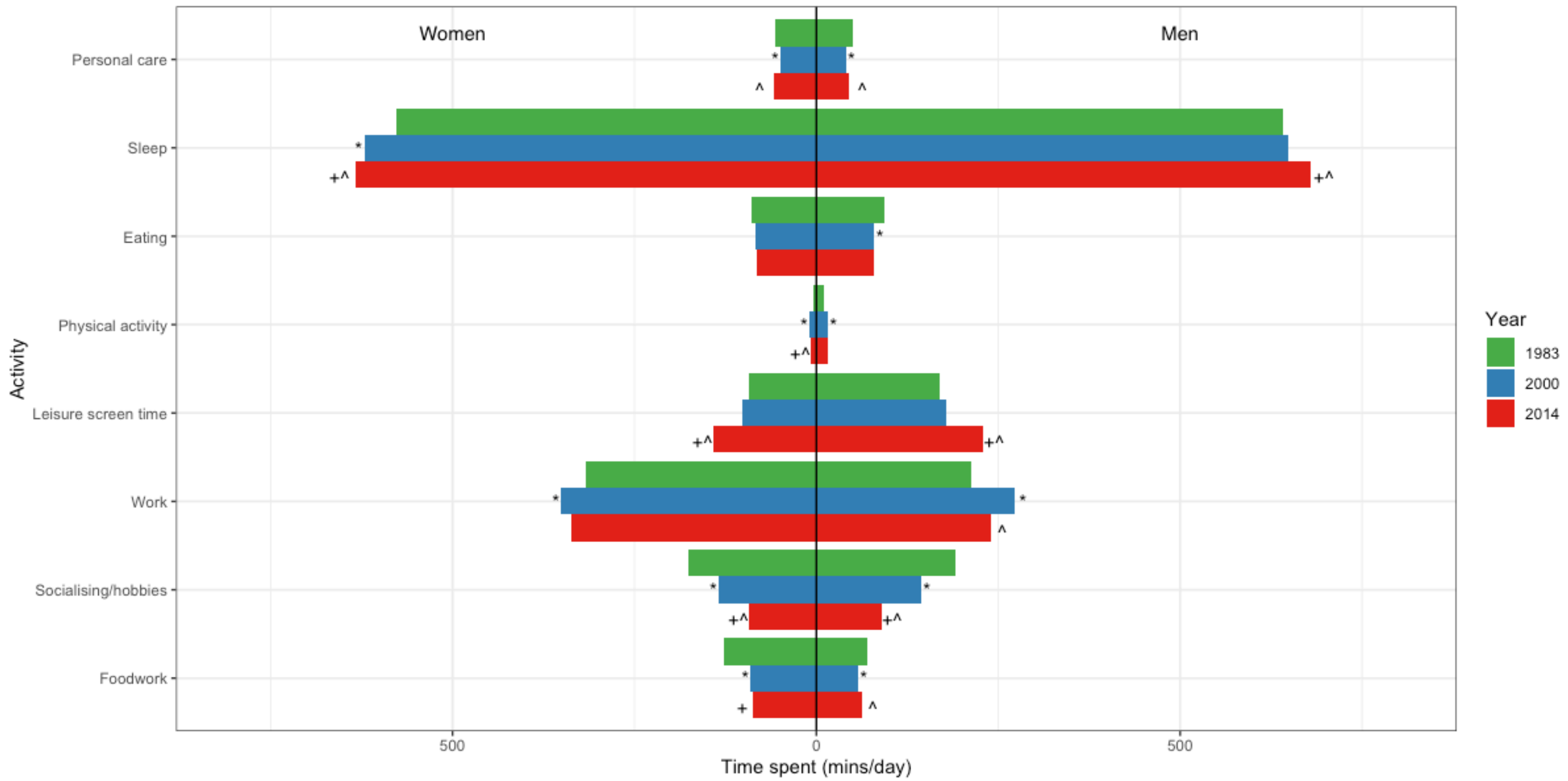
Among participants who engaged in foodwork, the trend in time allocated to foodwork was different for women than for men. While the time women allocated to foodwork decreased significantly between 1983 and 2014, the time men allocated to foodwork did not. Women continued to spend more time doing foodwork than men (24 minutes more in 2014, see Appendix 1), but the gap narrowed in the period since 1983, when it was 56 minutes. This was primarily attributable to a decrease in time spent on foodwork by women between 1983 and 2000.

Considering the same period that saw a significant decrease in time allocated to foodwork by women, women allocated significantly more time (45 minutes) to sleep in 2000 than in 1983, although women continued to allocate less time to sleep than men. Between 1983 and 2000, time allocated to work also increased significantly for both women and men. While it increased more substantially for men than for women (60 minutes compared to 33 minutes), women continued to allocate more time to work than men.

Among economically active and inactive participants who engaged in foodwork, time spent on foodwork decreased significantly between 1983 and 2014, though it decreased more substantially among economically inactive participants than among economically active participants, by 38 minutes compared to 18 minutes. However, economically inactive participants continued to allocate more time to foodwork. In the economically inactive group, time allocated to foodwork decreased significantly between 1983 and 2014, despite no corresponding increase in time spent on work.

Finally, time allocated to foodwork among participants who had less than secondary education decreased more substantially between 1983 and 2014 than among more educated participants. In 1983, participants who had less than secondary education allocated the most time to foodwork at 106 minutes, compared to 82 minutes among those with a secondary-level education and 90 minutes among those educated above secondary level. By 2014, the gap between participants with different education levels was much narrower, with participants allocating 64, 71 and 67 minutes for those educated below, at and above secondary level, respectively.

Figure 3 Model-adjusted[a] compositional means of time spent for participants who did foodwork, by gender (n=11,784)



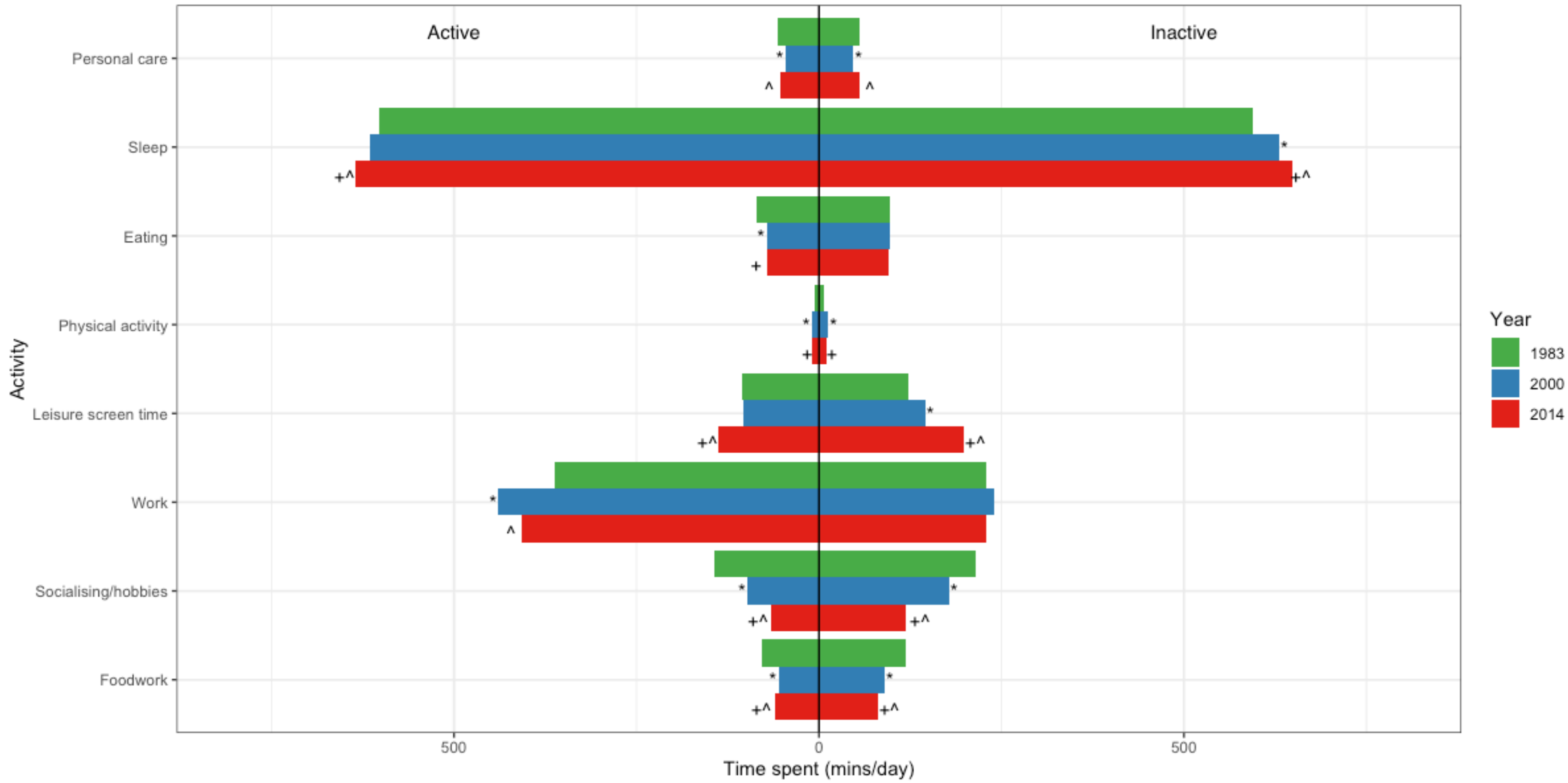
[a] Adjusted for age, economic activity, education, household type and diary day type

+ Statistically significant log-ratio difference between 2014 and 1983 for this part

^ Statistically significant log-ratio difference between 2014 and 2000 for this part

*Statistically significant log-ratio difference between 2000 and 1983 for this part

Figure 4 Model-adjusted[a] compositional means of time spent for participants who did foodwork, by economic activity (n=11,537)



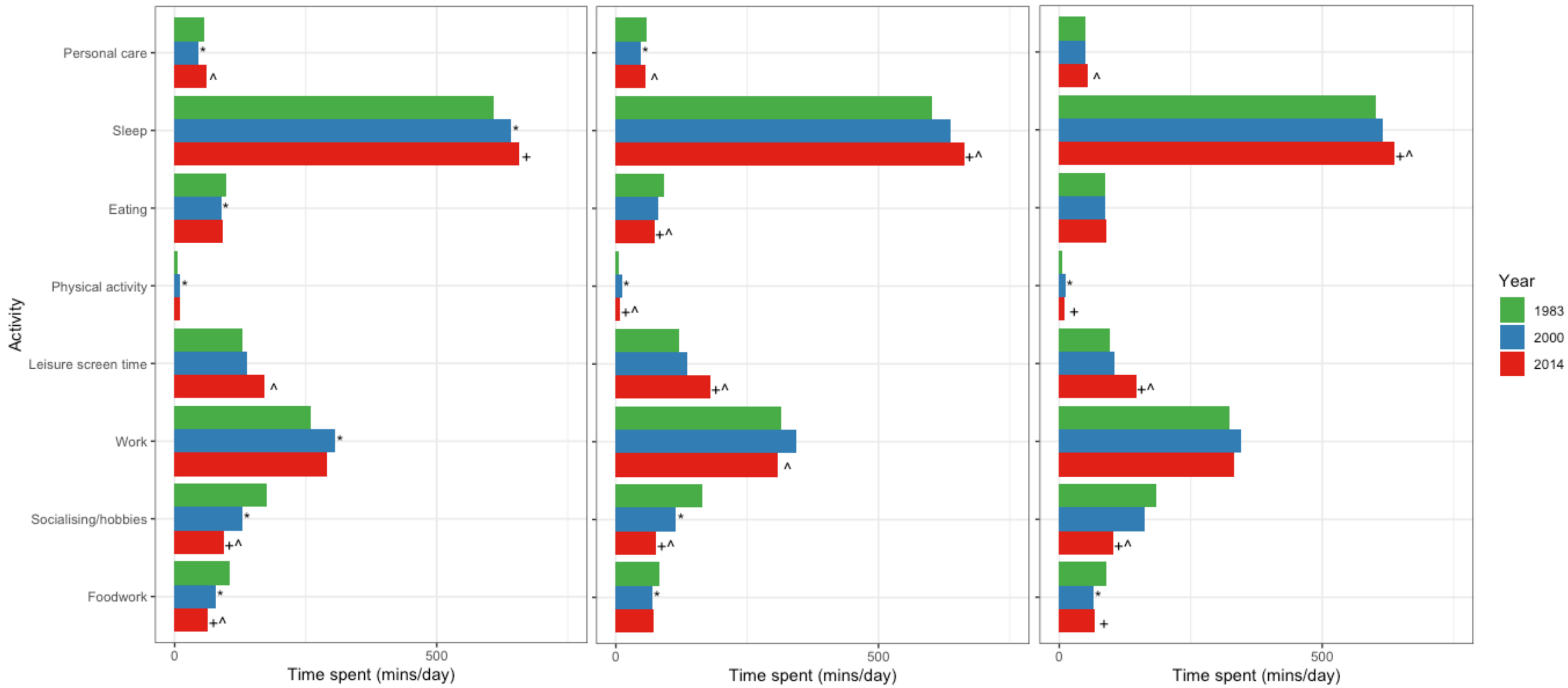
[a] Adjusted for age, gender, education, household type and diary day type

+ Statistically significant log-ratio difference between 2014 and 1983 for this part

^ Statistically significant log-ratio difference between 2014 and 2000 for this part

*Statistically significant log-ratio difference between 2000 and 1983 for this part

Figure 5 Model-adjusted[a] compositional means of time spent for participants who did foodwork, by education (n=10,823)



4-a Less than secondary 4-b Completed secondary 4-c More than secondary

[a] Adjusted for age, gender, education, household type and diary day type

+ Statistically significant log-ratio difference between 2014 and 1983 for this part

^ Statistically significant log-ratio difference between 2014 and 2000 for this part

*Statistically significant log-ratio difference between 2000 and 1983 for this part

2.5 2.5 Discussion

2.5.1 Statement of principal findings

Participation in foodwork decreased significantly over the period analysed, from 81% of the population in 1983 to 74% of the population in 2014. Among participants who engaged in foodwork, the median number of episodes of foodwork also decreased, from three in 1983 to two in 2014.

Women's participation in foodwork decreased significantly over the period, whereas men's participation did not. However, a larger proportion of women continued to engage in foodwork. Meanwhile, a larger proportion of participants living in single parent households engaged in foodwork than those living in other kinds of households, and engagement in foodwork among participants living in households with children did not decrease over this time period.

Among participants who engaged in foodwork, time spent on foodwork decreased significantly overall, due principally to a decrease of around 25 minutes between 1983 and 2000. In this same period, between 1983 and 2000, time allocated to work increased substantially. However, when time allocated to work decreased significantly between 2000 and 2014, there was no corresponding increase in time allocated to foodwork. Instead, time spent on sleep and leisure screen time, which had already increased between 1983 and 2000, increased again.

Trends in time spent on foodwork among those who engaged in this practice across the different survey years were different for men and women. While women allocated significantly less time to foodwork in 2014 than in 1983, the time spent by men did not change significantly. Women continued to spend more time on foodwork than men, although the gap narrowed.

Among economically active and inactive participants, time spent on foodwork decreased significantly between 1983 and 2014, though it decreased more substantially among economically inactive participants. Nevertheless, economically inactive participants continued to spend more time on foodwork. Time allocated to foodwork decreased significantly between 1983 and 2000 in the economically inactive group, despite the absence of the simultaneous increase in time spent on work which was observed in economically active participants.

2.5.2 Strengths and weaknesses of the study

To my knowledge, this study represents the first use of time-use diaries to explore how time spent on foodwork has evolved in conjunction with an array of other daily tasks and activities, as well as being the first analysis of time spent on foodwork in the most recent UK Time Use Survey (2014). Many studies have found that people feel they lack the time to prepare meals at home as often as they would like.[80,82,83,141–144] While in practice everyone has the same number of hours in a day, excessive demands on time may 'squeeze' the time available for activities such as foodwork. With this in mind, this analysis provides detailed evidence of the daily time use of participants, employing an analytic method that recognises the interdependence between different activities, instead of studying them in isolation.

While the term 'foodwork' has been used as a shorthand for the relevant activity codes in this harmonised data set, 'food preparation/cooking' and 'set table, wash or put away dishes', the activities captured are in reality only a subset of all the labour involved in doing foodwork. For one, shopping specifically for food cannot be identified in this data set, as it can when analysing the 2014 UK Time Use Survey in isolation (see Chapter 3), because not all of the included data sets differentiated between different types of shopping. Further, some active components of foodwork might not be captured due to the short amount of time they take, such as checking a dish in the oven. Perhaps more significantly, this measure probably does not capture a lot of the cognitive labour of planning and managing food, which may happen too sporadically for participants to capture it in a time use diary. Some of this labour may come in the form of a discrete task, such as making a meal plan or shopping list, or checking refrigerators and cupboards to determine what foods are present or needed. Much of the intellectual labour of foodwork may occur more as background mental processing at other times of day, such as thinking about how to include ingredients in meals to avoid food waste or remembering to pick up ingredients on the way home from work. Time use diaries do not seem like a particularly effective tool to capture this domain of foodwork, which is an important limitation. Nevertheless, these data do yield insight on substantive uses of time, which are an important dimension of what is experienced as time poverty.

This analysis uses survey data from three population-representative samples of UK adults. As mentioned in the description of the statistical analysis undertaken here, survey parameters cannot be applied to compositional data in the conventional way due to the relative nature of these data. Existing studies that have applied a compositional data analysis approach to population-based survey data have therefore omitted survey parameters.[151] However, this approach was deemed particularly problematic in combining multiple surveys (as in this analysis), as differential non-response varied across the survey years, with, for example, women being more strongly over-represented in the 1983 data. Using the weights provided by the Multinational Time Use Study team as sampling probabilities in a bootstrapped sample, as described in the methods section, helped to address differential non-response, making these results more generalisable to the UK population.

The difference in diary styles between 1983 and 2000 and 2014 (7-day diaries versus 2-day diaries) combined with some participants not completing all diary days or providing valid diaries on all days, let to an over-representation of weekdays in the 1983 data. However, analyses were adjusted for covariates, including day type, as were estimates of time allocated to different activities, which I hope has mitigated any bias this might have introduced. Further, the results presented in Table 2 suggest that participation in foodwork did not vary significantly between weekdays and weekend days, and a sensitivity analysis where weekdays and weekend days were analysed separately found that, while time use was different in some ways on weekdays and weekend days, time allocated to foodwork did not vary substantially. It also confirmed that the decrease in time allocated to work between 1983 and 2014 was not an artefact of the uneven samples, as the trend was visible when analysing both weekdays and weekend days in isolation. This is a result of adjusting for day type when producing estimates of compositional mean.

I chose to limit this study to three survey years, 1983, 2000 and 2014, because they capture time use in 10- or 15-minute time intervals. While earlier, nationally representative time use data exists, earlier surveys use 30-minute time intervals. While it would have been useful to be able to include earlier time points in this analysis, I chose to exclude the other surveys because of the difference in time intervals, as these may have substantially impacted estimates of both participation in and time spent on foodwork.

This study uses self-reported data on daily activities, where objective data might give a truer picture of daily time use. However, currently objective data of this sort (e.g. from a wearable camera) is not available in such a large data set, nor in data collected at time points in the past. Objective data would also not address the key limitation of failing to capture cognitive labour. Further, while participants may over-estimate activities they see as socially desirable, data from time-use diaries has been shown to be less liable to over- and under-reporting than questions about a specific set of activities, as participants must fit all daily activities into a 24-hour period.[166] Finally, validation studies using wearable cameras and accelerometers suggest time use diaries are reasonably reliable.[166]

In this study, I have assumed zero values to be ‘rounded’ as opposed to ‘essential’ zeros (defined above, 2.3.1 Understanding compositional data). In this way, I avoided having to omit a substantial number of participants from my analysis, which may have biased my results. I attempted to create my activity sets (or parts) in such a way that most participants could in theory be expected to engage in them on a daily basis, for example by combining paid and unpaid work, and by including walking in physical activity. However, some participants may have had essential zero values for some activities.

A final, and important, limitation of this analysis is that it is an observational study using repeated cross-sectional surveys. While this allows us insight into how daily practices have changed over time, it is difficult to draw a causal link between a reduction in time allocated to one activity and an increase in time allocated to another, or vice-versa. Changes in foodwork could have caused changes in other activities, or changes in other activities could have caused changes in foodwork, or changes across several activity sets could be driven by a factor which is not measured here. An experimental study which looked at how increasing time allocated to foodwork impacted other activities would be useful in establishing causal relationships.

2.5.3 Comparison with previous work

To my knowledge, this is the first analysis of foodwork in the UK using data from the most recent UK time use study (2014). It is also the only analysis of time spent on foodwork in the context of other daily tasks and activities, using a compositional data analysis approach to take into account the interdependence between different uses of time.

However, as discussed in the introduction to this chapter, previous analyses have examined how time spent on foodwork has changed over time in the UK and elsewhere.[10–

[13,147,148] The results presented here suggest that foodwork in the UK has evolved in a different manner than it has in the United States over a roughly contemporaneous period, with time spent on and participation in foodwork increasing between 2003 and 2016 in the US, but decreasing in the UK between 2000 and 2014.[13] That being said, participation in foodwork in the United States was lower overall in 2016 than I found it to be in the UK in 2014: in the United States, 70% of women and 46% of men engaged in foodwork, while in the UK 83% of women and 64% of men engaged in foodwork. The analysis of US time diaries referred to 'home cooking' as opposed to foodwork, though the concept being referred to was defined in a very similar way to here, suggesting the two are comparable.[13] Prior to 2000, a smaller proportion of men in the United States engaged in foodwork, at 29% in 1975 and 47% of men in 1985,[148] than in the UK, at 52% of men in 1975[10] and 65% of men in 1983 (shown here), as they continued to do in more recent years. However, the gap between the United States and the UK in terms of women's participation appears to be growing, given that 85% of women in the United States participated in foodwork in 1985,[148] compared to 91% of women in the UK in 1983.

Other studies have used UK time use diaries to examine changes in time allocated to some of the other activity domains analysed here. One result of this analysis that may seem counter-intuitive is the substantial increase in time spent on sleep. However, this is consistent with an existing analysis of sleep using time use diaries from the UK,[167] which found that between 1974 and 2014, time spent sleeping increased by approximately 43 minutes. The authors hypothesised that contemporary concerns over sleep deprivation, which seem to persist despite this apparent increase in time spent sleeping, could be attributed to either worsened sleep *quality*, or greater recognition of the importance of sleep to good health.

2.5.4 Meaning of the study: possible mechanisms and implications for practice and research

In this study, I found that participation in foodwork decreased between 1983 and 2014, as did time allocated to foodwork and the number of daily episodes of foodwork among those who engaged in this practice. However, participation rates are still relatively high: as noted above, foodwork participation in the UK appears to be substantially higher than in the United States.[13] This suggests that foodwork, and the home-prepared food that may sometimes, but not always, result from it, continue to play an important role in the lives of UK adults. This supports existing research about the relatively high frequency with which adults in the UK prepare meals at home.[168]

It is plausible that a decrease in time spent on foodwork reflects, to some extent, a change in meals that have become more or less popular over the 30-year period analysed here: a stir fry or a salad might take less time to prepare (and clean up after) than a roast dinner or cottage pie. It is also plausible that some labour-saving innovations have increased in prevalence, which might not necessarily have an impact on dietary intake, such as dishwashers, or pre-washed or pre-prepared vegetables. Analysis of the changing popularity of different meal types over time as well as changes in dietary intake would have to be carried out to test these hypotheses. Changes in tastes, ingredients or technology might alter the association between time spent and the resulting food. However, the decreased participation in foodwork, as well as the decrease in the number of daily episodes of foodwork from three to two, suggest that this may also reflect the production and consumption of fewer home-prepared meals in contemporary times.

An examination of how the allocation of time to other activities has changed allows me to hypothesise about what could be driving the decline of foodwork. As noted in the introduction to this study, Gershuny and Sullivan suggest that changes in time allocation reveal the changing material constraints which might lead social groups to organise their practices differently, as well as how social norms may be changing.[150] There is evidence to suggest the effects of both material constraints and social norms in these findings. Where time spent on foodwork decreased significantly, between 1983 and 2014, the concurrent increase in time spent on work might suggest that a material constraint, in terms of an increase in demands on people's time in the form of paid of unpaid labour, was driving a decrease in time spent on foodwork. However, I also see a decrease in time allocated to foodwork among economically inactive participants over this period, even where there was no increase in time spent on work. Further, when time spent on work decreases among the economically active population, and the sample as a whole, time spent on foodwork does not return to its original level. Instead, I see an increase in time spent on sleep and leisure screen time. Together, this evidence suggests that at least part of the changes in foodwork may be attributed to social norms rather than economic constraints.

This does not mean that a 'lack' of time, in the form of a greater amount of time needed to be spent on work, plays no role in shaping how much time is allocated to foodwork. Indeed, this mechanism is suggested by the greater amount of time allocated to foodwork among economically inactive participants (a group dominated by retired participants in these samples), who may have more discretionary time as they spend less time on work.

The frequency with which a lack of time is reported[80,82,83,141–144] as a barrier to home food preparation suggests that this barrier is powerful within people's experiences and narratives. These results suggest that a 'lack' of time may have multiple meanings. Numerous demands on time may decrease the availability of time for foodwork, which may mean that time-saving devices, such as 'quick' recipes or pre-prepared ingredients may be useful for some. However, the findings presented here are not coherent with the idea of a lack of time, at least in the form of more time needing to be spent on work, as a particular feature of contemporary life.

Instead, the decline in foodwork may be driven by other changes. One explanation may be that people say they lack the time to cook when what they really mean is that they do not want to, or that there are other things they would prefer to be doing with their time. After all, leisure screen time has increased substantially over the period examined here. As discussed in Chapter 1, preparing food at home is a practice to which a substantial amount of social, cultural and even moral value is ascribed. This may make it difficult for people to just say that they do not prepare food at home because they do not want to, or do not want to enough to give up other activities they might prefer. Further, the multiplication of ways to eat without preparing food at home may have contributed to making domestic foodwork less appealing or more expendable. If this is the case, more effective interventions might address the other sources of food and meals which are being incorporated into diets, aiming to make these other foods healthier. While food practices may vary between individuals, healthy foods should be available to all.

Another explanation may be that what is articulated as a lack of time is in fact more akin to a heightend cognitive load. Individuals living in a contemporary industrialised society are overwhelmed with food-related decisions on a daily basis, decisions pertaining to what, when, where, how much, and with whom to eat. Each of these decisions costs individuals in terms of their attention or cognitive load, meaning other decisions are side-lined or become more difficult. Food and cooking cultures, which dictate, for example, what can and cannot be eaten, or what constitutes a 'proper' meal,[169] go some way to limiting the number of choices an individual has to make. An erosion of the social structuring of food choices may be making these choices much more unstructured and individualised.[170] If a sense of being overwhelmed is what is being articulated as a lack of time, the interventions might be different again, with recipe boxes or vegetable boxes as a possibility to reduce the number of choices that must be made.

Finally, the gendered dimension of trends in foodwork is important to note. While both participation in and time spent on foodwork decreased between 1983 and 2014, this was principally due to a decline in women's foodwork, while among men changes were not significant. While advocates of home cooking and home-cooked meals may see cause for concern in the decline of foodwork, the fact that men appear to be doing a larger proportion of foodwork than they did in the past suggests a less unequal, though still far from equal, division of foodwork is gaining greater prevalence. Nevertheless, women continue to participate in foodwork in larger numbers, and to spend more time on foodwork when they engage in it. Practitioners seeking to encourage home food preparation need to be very wary of the gendered nature of foodwork, and develop interventions that specifically address this inequality. Formal food education in schools, made mandatory for all students, has been advocated as an approach to encourage home cooking in a way that eschews the gendered division of foodwork.[31]

2.6 Conclusion

Between 1983 and 2014, participation in foodwork decreased in the adult population of the UK, as did the number of daily episodes of foodwork and the time spent on foodwork among those who participated in this practice. This trend was principally driven by a decline in women's foodwork, whereas men's foodwork did not change significantly. Trends were also somewhat variable across other population sub-groups.

Despite these findings, foodwork continued to play an important part in participants' lives, with 74% of the sample engaging in foodwork on a given day. Looking at daily time use as a composition, while time spent on foodwork decreased, there was no concurrent increase in time spent on other forms of work, be they paid or unpaid. Meanwhile, time spent on both sleep and leisure screen time increased substantially over the same period. These results suggest that what is expressed as a 'lack of time' to prepare food at home may not represent merely a lack of a few minutes that are devoted to other non-discretionary activities. Instead, a ‘lack of time’ may stand in for a lack of desire or interest, or a sense of being overwhelmed in the face of a high cognitive load. Interventions must be tailored to truly address this often-repeated barrier to home food preparation, while also keeping in mind the evidence presented here, and elsewhere, that foodwork and home-prepared food continue to play a crucial role in the foods people consume and the way they allocate their time.

3 HOW DOES TIME USE DIFFER BETWEEN INDIVIDUALS WHO DO MORE VERSUS LESS FOODWORK? A COMPOSITIONAL DATA ANALYSIS OF TIME USE IN THE UNITED KINGDOM TIME USE SURVEY 2014-15

3.1 Abstract

Background: Increased time spent on home food preparation is associated with higher diet quality, but people do not prepare food at home as often as they would like because they feel they lack the time. However, variation in time use between participants who do more or less foodwork (tasks required to put a meal on the table, including home food preparation) has not been examined.

Methods: Cross-sectional analysis of data from United Kingdom Time Use Survey 2014-15 participants aged 19 and over (N=5878). Time use over 24 hours was categorised into seven parts, forming a composition: (1) personal care; (2) sleep; (3) eating; (4) physical activity; (5) leisure screen time; (6) work (paid and unpaid); and (7) socialising and hobbies. Participants were categorised as doing no foodwork, and then according to a median split of ‘some’ foodwork (<70 minutes), or ‘more’ foodwork (≥70 minutes). I used compositional multivariate analysis of variance to test whether the time-use composition varied between those who did no, some and more foodwork. Linear regression models and bootstrap confidence intervals were used to determine which of the parts varied between groups. I tested for interactions with three characteristics that have been evidenced to influence both foodwork and time use (gender, economic activity and children in the household), performing stratified analyses where appropriate.

Results: Time-use composition varied significantly between foodwork groups. Participants who spent more time on foodwork spent less time on sleep, eating and personal care, and more time on work. Women who did more foodwork spent less time on personal care, socialising and hobbies, but this was not the case for men.

Conclusion: Research examining how time use changes as a result of home food preparation interventions is required. Those who seek to encourage home food preparation should be aware of the associations between foodwork and other activities, and design their interventions to guard against unintended consequences.

3.2 Introduction

The drivers of dietary intake and related food practices are complex. Observational evidence suggests that higher frequency of both making[49,54–57] and eating home-prepared meals[49,50,137] is associated with better dietary intake and improved health outcomes. As a result, substantial energy has been devoted to understanding the modifiable determinants of home food preparation, and increasing the amount of food preparation undertaken in households.[80,81,87–90,139,171,172]

While most research has focused on how frequency of eating home-prepared food associates with diet quality or the intake of different foods and nutrients, some researchers have also explored the time spent on 'foodwork', or the tasks required to put a meal on the table, including food preparation, but also food shopping, cleaning up after a meal, and washing dishes.[43] Several studies have explored how time spent on foodwork has changed over the years in different national contexts.[12,13,147] For example, a study of time-use in the UK found that time spent on food preparation decreased by 16 minutes between 1975 and 2000, but that participation in home food preparation had increased in the same time period (from 75% to 83% of the sample), a change driven principally by the increasing participation of men in this task.[10]

Time is an important dimension of foodwork as increased time spent on foodwork has been shown to positively impact the resultant diet.[138] First, more time spent on foodwork may represent a higher frequency of preparing meals at home. Second, more time spent on foodwork may represent a particular kind of home food preparation, preparing food 'from scratch',[83] or from unprocessed or minimally processed ingredients, which has been posited to be particularly important to achieving high diet quality.[139]

Beyond its potential association with diet quality, time is an important dimension in understanding home food preparation due to the frequency with which a lack of time is cited as a barrier to this practice, and the importance of time and convenience in structuring food practices and attitudes towards them.[140] Studies based on quantitative surveys, interviews and ethnographic work show that participants prepare food at home less often than they would like because they feel they lack the time to do so.[80,82,83,141–144]

As interventions designed to increase the frequency of home food preparation and increase cooking 'from scratch' are being implemented,[87–89] this key barrier is worthy of further exploration. While income-related barriers to healthy eating have been extensively explored and, to some extent, integrated into theory and intervention design, evidence assessing associations between time scarcity and healthy eating behaviours is more limited, and few interventions have explicitly addressed time as a barrier to healthy eating.[84] Where home food preparation interventions have sought to address time scarcity, they have sometimes done so by providing 'quick' recipe ideas on cards or websites, such as the online cooking and nutrition resource 'No Money No Time'.[117]

Self-evidently, everyone has the same number of hours in a day. Time 'poverty' or 'scarcity' refers not to having fewer hours but to more demands being placed on those hours.[83,133] These demands can come in the form of paid employment, domestic tasks or caring duties.[83] Indeed, individuals with high demands on their time, such as parents of young children who are employed outside the home, have been shown to prepare food at home less frequently.[141,143] However, Southerton and Tomlinson highlight that the experience of 'harriedness' endemic in the contemporary era may go beyond this requirement to spend time on necessary tasks, and extends to other aspects of time such as the weakening of socio-temporal structures, where increasingly unfixed schedules for things like work and meal times make it difficult to coordinate activities with families and households, and 'temporal density', involving multi-tasking and the erosion of boundaries between discrete tasks.[118] Nevertheless, the impact of demands on time in the form of paid or unpaid work to the experience of harriedness remains important. In an analysis of various measures of 'time intensity', including multi-tasking and task switching, with self-reported feelings of being rushed, it was found that the strongest predictor of feeling rush was time spent on work.[145]

Understanding what a lack of time means, practically, may be helpful in understanding whether different home food preparation interventions might be expected to work. It is also worth exploring whether making the desired change to more time spent on foodwork might be expected to lead to unintended consequences, depending on how individuals accommodate this new demand on their time and where they draw time from. To explore this, foodwork must be examined in conjunction with other daily activities.

Compositional data analysis is a technique that has recently been applied to the study of time allocated to health behaviours such as physical activity.[151–153] This approach construes a 24-hour time budget as a composition made up of different activities, or parts, and takes into account some key properties of time noted above: that time is bounded, and that time spent on one activity necessarily involves a trade-off with other activities. In other words, more time spent on foodwork means less time is being spent on other activities.

While compositional data analysis has been applied in the field of nutrition to explore the nutritional composition of diets,[154] as far as I am aware, it has not yet been applied to time spent on food practices in the context of other daily activities. The aim of this study was to use time-use diaries to explore the cross-sectional relationship between the extent of engagement with foodwork and the structure of a 24-hour time budget (i.e. how much time people spend on daily activities). In analysing this time budget, I examined some activities which are explicitly health-promoting, such as sleep and physical activities, and others which are necessary to social, personal and economic wellbeing, such as work (paid and unpaid, in and outside the home), socialising, and leisure.

I further identified differences in this relationship between population sub-groups, looking at three dimensions which have been shown to impact both time use and foodwork: gender, economic activity and the presence of children in the household.[12,141,143,173,174]

3.3 Methods

3.3.1 Data source

This study presents a secondary analysis of the 2014-15 United Kingdom Time Use Survey (UKTUS),[175] a cross-sectional national survey of UK residents aged 8 years and over.

A detailed account of the UKTUS recruitment and sampling protocol has been published elsewhere.[176] In short, private addresses were randomly sampled from postcode sectors across the UK. From a total sample of 11,860 households, 10,479 were eligible. Ineligible households included non-residential addresses, holiday homes and vacant buildings. Within each eligible household, one individual was asked to complete a household demographic questionnaire. Following this, all individuals in included households were asked to complete an individual demographic questionnaire and two 24 hour time-use diaries (one on a weekday, the other on a weekend day). Of the 10,479 eligible households, 40.4% responded, meaning a household questionnaire was completed, along with an individual questionnaire and one or two diary days from at least one resident. The study was approved by the Research Ethics Committee of the Department of Sociology at the University of Oxford (2014_01_02_R1).

3.3.2 Time use diaries

Participants were asked to fill out a time-use diary day for one weekday and one weekend day. Diaries started at 4 am and covered a full 24-hour period. This period was divided into 10-minute time intervals, and participants were asked to fill in a primary activity for each time interval. Participants also recorded their location for each time interval and had the possibility of recording up to three secondary activities, although only primary activities were examined in this analysis. All responses were given in free text, and the diaries were coded by the study team using 281 a priori activity codes.[176]

3.3.3 Exclusion criteria

A series of quality checks suggested by the UKTUS study team were applied to the diary days, where diary days characterised by too many 'flags' indicating poor quality were excluded. These flags were: having more than 90 minutes of missing time, reporting fewer than seven episodes of activity (i.e. seven changes between activity or location), and missing two or more of four basic activities (sleeping/resting, eating/drinking, personal care and exercise/travel).[163] Diary days having all three of these flags were excluded. I further excluded any diary days that did not report a full 24 hours of eligible activity codes (i.e. where at least one time interval had been coded as, for example, 'unspecified time use' or 'illegible activity'), as this would prevent the diary from being interpreted as compositional data. Finally, diary days reporting zero minutes spent on sleep were also excluded as being extremely atypical representations of the 24-hour time budget. Of the diary days that passed these quality checks, I randomly selected one time-use diary day (either a weekday or a weekend day) for each participant aged 19 years or over.

3.3.4 Definition of exposure (foodwork)

I summed daily time spent on foodwork for each participant on the included diary day, meaning total time spent doing any of the following activities: shopping for food, food preparation and management, or washing dishes. I assigned participants to one of three categories of my foodwork variable based on the amount of foodwork they had recorded: 'no foodwork' (no time spent); 'some foodwork' (below the median amount of time spent for those who engaged in foodwork); and 'more foodwork' (above the median amount of time spent for those who engaged in foodwork).

3.3.5 Definition of outcome (time-use composition)

As described in Chapter 2 (2.3.1 Understanding compositional data), compositional data are made up of mutually exclusive parts which sum to a whole, such as 100% or, in this case, 24 hours.[157] Transforming time-use data into a composition requires classifying time spent into different categories, with each category representing a part of the composition. I partitioned each participant's time-use diary into seven mutually exclusive activity sets (parts) based on the primary activity they had reported in each time slot:

1. Personal care (e.g. showering, grooming)
2. Sleep (including time spent in bed sleeping or in bed while not doing another activity)
3. Eating
4. Physical activity (including walking, and active transport by foot or bicycle)
5. Leisure screen time
6. Work (including paid work as well as unpaid domestic work such as foodwork, housework and caring)
7. Socialising and hobbies not captured elsewhere

The specific activities included in each part are described in Appendix 2.

All participant time could be allocated to one of these parts. Time spent travelling was allocated to the activity it enabled. For example, time spent travelling to a workplace or to drop children off at school was allocated to work, while time spent travelling to a friend's house for dinner became part of time spent socialising. This was true with the exception of active travel (by foot or bicycle), which was coded to physical activity.

Our parts reflected an interest in activities that are important to physical health, such as sleep and physical activity, as well as activities that may be necessary or important for broader dimensions of social, economic or psychological wellbeing, such as work or socialising. This is because my exposure – time spent on foodwork – has been advocated as being conducive to physical health, and so I wanted to see how it associated with other health-related behaviours. Simultaneously, as noted above, several studies have found that participants cook from scratch less often than they would like to, or feel they should, because they lack the time to do so, presumably because of the competing demands of other activities. As a result, I wanted to look at associations between foodwork and a full spectrum of activities.

For this analysis I treated zeros as rounded, replacing zeros with small values under 10 minutes by drawing time from other parts using a log-ratio data augmentation algorithm. my parts were defined in such a way that it seemed likely that most participants would spend at least a small amount of time engaging in each of the groups of activities. Because participants were asked to record their activities in blocks of 10 minutes, I assumed that some activities would not take enough time or have enough perceived importance to be recorded as lasting 10 minutes but would nevertheless occur between other activities recorded throughout the day.

3.3.6 Covariates

Covariates were self-reported in the individual demographic questionnaire and were age, gender, economic activity (as defined by the Office for National Statistics: economically active, i.e. in paid employment or actively seeking work, or economically inactive[177]), occupational class (classified based on current or most recent employment using the simplified three-class version of National Statistics Socio-economic Classification described by the Office for National Statistics,[178] or not applicable for those who were not and had never been in paid employment), age at leaving full-time education and presence of children in the home, as well as diary day type (weekend day or weekday) for the selected diary. Income was included in the survey but was not considered in this analysis due to substantial data missingness.

3.3.7 Analysis

I described the socio-demographic characteristics and the median time spent on foodwork for the whole sample and in each foodwork group. I conducted chi-square tests or one-way ANOVAs to determine whether there were statistically significant differences in the socio-demographic characteristics of each foodwork category. I then described the patterns of zero values in the time-use composition. All subsequent analyses were performed on the imputed compositions, where zero values had been replaced by small non-zero values, drawing time from other parts.

In order to test for differences between groups of compositions (time-use compositions for participants reporting no foodwork, 'some' foodwork and 'more' foodwork), I followed the procedure suggested by Martìn-Fernandez and colleagues in their paper on interpreting differences between groups of compositional data.[156]

First, I used a compositional multivariate analysis of variance (MANOVA) to determine whether the three groups differed.

Second, if the results of the MANOVA suggested rejecting the null hypothesis of equality of means between the three groups of compositions, I used a Hotelling's *T*-squared test, the multivariate generalisation of a standard *t*-test, to determine which pair of groups – none and some, or some and more – were different.[156] I chose not to analyse the third potential pair, none and more, as being less conceptually meaningful than the other pairs, and therefore yielding results that would be difficult to interpret.

Third, where differences between two particular groups were detected, I estimated adjusted compositional means for each group. To do so, I transformed the compositional data using an isometric log-ratio (ilr) transformation. This transformation produces a set of ilr coordinates numbering one fewer than the number of parts.[156] In this seven-part composition, six ilr coordinates were produced, taking the form of a ratio between one part and another part or parts.

Linear regression models were created with the ilr coordinates as outcome variables and the categorical foodwork variable as the exposure, along with the other covariates. For each category of the foodwork variable (none, some and more), I estimated the adjusted mean ilr coordinate value for each of the six ilr coordinates. I then back-transformed these ilr coordinate estimates to obtain the model-adjusted compositional means of time spent in each of the seven parts for participants who fell into each of the three foodwork categories.

Finally, I calculated the log-ratio differences in adjusted compositional mean between both pairs of groups: none vs some and some vs more. Log-ratio differences are log-transformed ratios, where the numerator is the model-adjusted minutes per day spent on a given part in a given group of participants, and the denominator is the model-adjusted minutes per day spent on the same part in another group of participants. For example, this could be the model-adjusted time spent sleeping in participants who do some foodwork compared to the model-adjusted time spent sleeping in participants who do no foodwork. In order to determine whether the difference in time spent was significant at the critical level, I constructed confidence intervals for each part using a bootstrap technique.[156] Confidence intervals that crossed zero indicated that there was no between-group difference for this part.

In order to determine whether these associations were different across different population sub-groups, I entered interaction terms into the Hoteling's *T*-squared models to determine whether the relationship between foodwork and time-use composition differed by gender, employment status, or presence of children in the home. Where the interaction term was significant, I stratified the sample and performed the analysis again for each subgroup, estimating the model-adjusted compositional mean time spent in each part, and calculating the log-ratio differences and confidence intervals for each part in, for example, men and women separately.

For this analysis I used the open source software R (www.r-project.org) and a number of bespoke packages for the analysis of compositional data, including Hotelling, lsmeans, Compositions, zCompositions, and robCompositions. Throughout this analysis I adjusted the critical level (0.05) in proportion to the number of groups analysed using the Bonferroni correction in order to prevent the artificial increase of the Type I error rate, as suggested by Martìn-Fernandez and colleagues.[156] This resulted in a critical level of 0.017, which was used throughout.

Due to the relative nature of compositional information, applying weights to compositional data in the conventional way, as a multiplicative factor, is not feasible. In order to make these estimates population-representative, I instead used the weights provided by UKTUS as sampling probabilities, using a bootstrap technique to resample a weighted sample from the 'real' sample.

3.4 Results

3.4.1 Sample characteristics

The full data set provided by the UKTUS team consisted of 16,533 time-use diary days from 8274 participants. Of these, 23 diary days failed the general quality checks recommended by the study team, and 5005 diary days failed the quality checks specific to this analysis (4988 reporting less than 24 h and 17 reporting no sleep). Of these valid diary days, 1692 were filled out by those aged under 19 years. After applying all of these exclusion criteria, I randomly selected one diary day from each participant, creating an analytic sample of 5878 diary days from 5878 participants.

Table 5 describes the characteristics of the analytic sample by foodwork category. Among participants who reported doing foodwork, the median amount of time spent on foodwork was 70 minutes. Participants doing less than 70 minutes of foodwork per day were therefore assigned to the 'some' foodwork category, with participants doing 70 minutes or more of foodwork assigned to the 'more' foodwork category.

Participants in the higher foodwork categories were significantly older, with participants in the more foodwork category having a mean age of 53 years, while participants in the no foodwork category had a mean age of 45 years. Women were over-represented in the more foodwork category, while men were over-represented in the no foodwork category. Economically inactive participants – a group dominated in this sample by retired individuals – were over-represented in the more foodwork category relative to economically active participants. Meanwhile, participants who were still in full-time education were under-represented in the more foodwork category. Weekdays were slightly over-represented in the some foodwork category, perhaps reflecting shorter but more regular foodwork on days when participants were at work or school.

Foodwork category varied significantly by occupational grade, and age at finishing full-time education, two variables which have been used to measure socioeconomic position. Those who were in professional or managerial occupations as well as those who had finished full-time education after the age of 16 were slightly over-represented in the some foodwork category. Those who were in routine and semi-routine occupations as well as those who had finished full-time education at or before the age of 16 were slightly over-represented in the no or more foodwork categories.

Table 5 Characteristics of analysis sample (n= 5878)

	No foodwork	Some foodwork	More foodwork	Total		
Participants (n)	1292	2366	2220	5878		
Foodwork (mins/day, median (IQR))	0 (0)	30 (20,50)	110 (90,150)	40 (10,90)	F	p value
Age (years, mean (SD))	44.9 (17.4)	47.9 (16.9)	53.4 (17.1)	49.3 (17.4)	115.6	**<0.001**
	Proportion of foodwork category (n (%))				Pearson χ^2	p value
Gender						
Male	870 (67.34)	1241 (52.45)	676 (30.45)	2787 (47.41)	485.99	**<0.001**
Female	422 (32.66)	1125 (47.55)	1544 (69.55)	3091 (52.59)		
Economic activity						
Economically active	958 (74.21)	1604 (68.05)	1100 (49.80)	3662 (62.52)	258.66	**<0.001**
Economically inactive	333 (25.79)	753 (31.95)	1109 (50.20)	2195 (37.48)		
Occupational grade						
Professional or managerial	440 (34.21)	918 (38.83)	736 (33.18)	2094 (35.69)	37.82	**<0.001**
Intermediate	374 (29.08)	693 (29.31)	628 (28.31)	1695 (28.89)		
Routine and semi-routine	369 (28.69)	586 (24.79)	612 (27.59)	1567 (26.70)		
Not applicable	103 (8.01)	167 (7.06)	242 (10.91)	512 (8.73)		
Children in household						
Yes	414 (32.04)	737 (31.15)	707 (31.85)	1858 (31.61)	0.40	0.82
No	878 (67.96)	1629 (68.85)	1513 (68.15)	4020 (68.39)		
Age at finishing full-time education						
Still in education	188 (14.55)	342 (14.45)	217 (9.77)	747 (12.71)	40.09	**<0.001**
16 or under	538 (41.64)	887 (37.49)	980 (44.14)	2405 (40.92)		
Over 16	566 (43.81)	1137 (48.06)	1023 (46.08)	2726 (46.38)		
Diary day						
Weekday	643 (49.77)	1263 (53.38)	1064 (47.93)	2970 (50.53)	14.01	**0.001**
Weekend	649 (50.23)	1103 (46.62)	1156 (52.07)	2908 (49.47)		

3.4.2 Differences between time-use compositions across foodwork categories

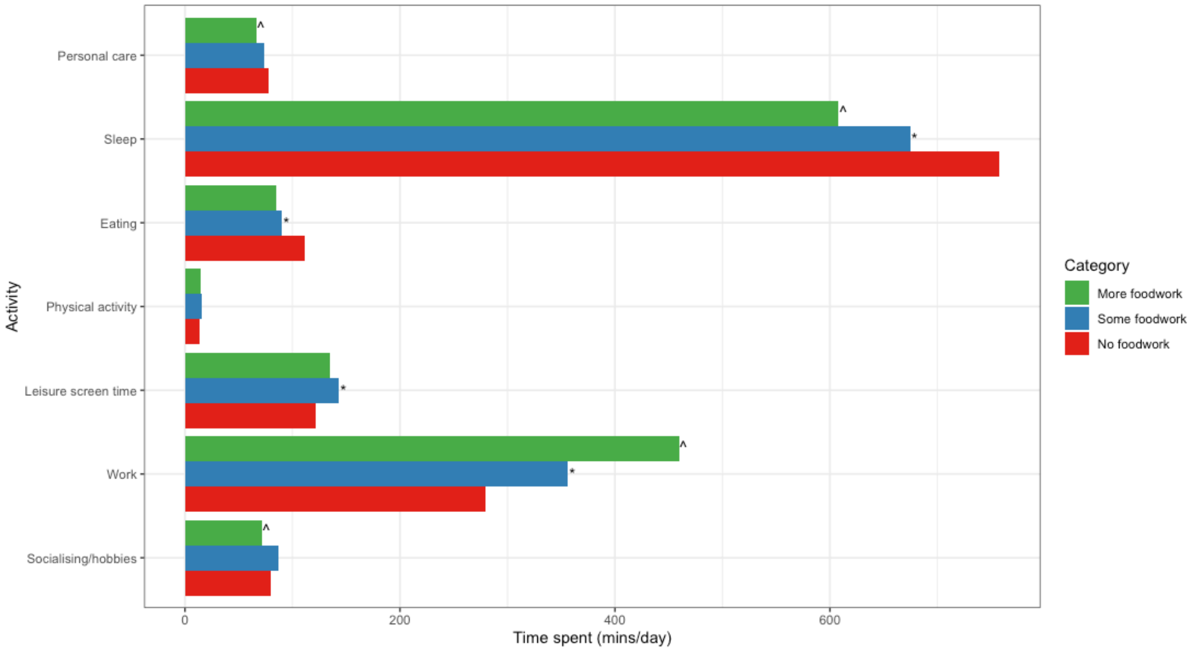
All subsequent analyses were performed on the imputed compositions, where zero values were replaced with small non-zero values as described in the methods. Patterns of zeros in the time-use composition are reported in Appendix 2. After adjusting for covariates, the compositional MANOVA suggested there was a statistically significant difference in time-use composition between those reporting no foodwork, some foodwork and more foodwork. The Hotelling's T-squared test further suggested there was a statistically significant difference in time-use composition between both pairs of groups: no foodwork and some foodwork, and some foodwork and more foodwork. It was therefore necessary to analyse differences in parts between both of these pairs.

3.4.3 Differences between foodwork categories for individual activities

The model-adjusted compositional means for each part, presented separately for those reporting no foodwork, some foodwork and more foodwork, are shown in Figure 1. Symbols indicate a statistically significant log-ratio difference between foodwork categories for each part ($p<0.017$).

The numerical values underlying Figures 6, 7 and 8 are in Appendix 2.

Figure 6 Model-adjusted[a] compositional means by foodwork category (n=5878)



[a]Adjusted for age, gender, employment status, education, occupation, presence of children and diary day type

^ Statistically significant log-ratio difference between more and some foodwork for this part

*Statistically significant log-ratio difference between some and no foodwork for this part

As amount of foodwork increased, more time was spent on work (a part which includes foodwork, but also all other forms of work, both paid and unpaid), from 279 minutes among those who did no foodwork, to 356 minutes among those who did some foodwork, to 459 minutes among those who did more foodwork. Meanwhile, time spent on sleep decreased as amount of foodwork increased.

Relative to participants who did some foodwork, participants who did no foodwork spent more time eating (21 minutes, see Appendix 2) and less time watching screens (20 minutes). Meanwhile, participants who did more foodwork spent less time on personal care (7 minutes) and socialising and hobbies (16 minutes) relative to participants who did some foodwork.

3.4.4 Effect modification

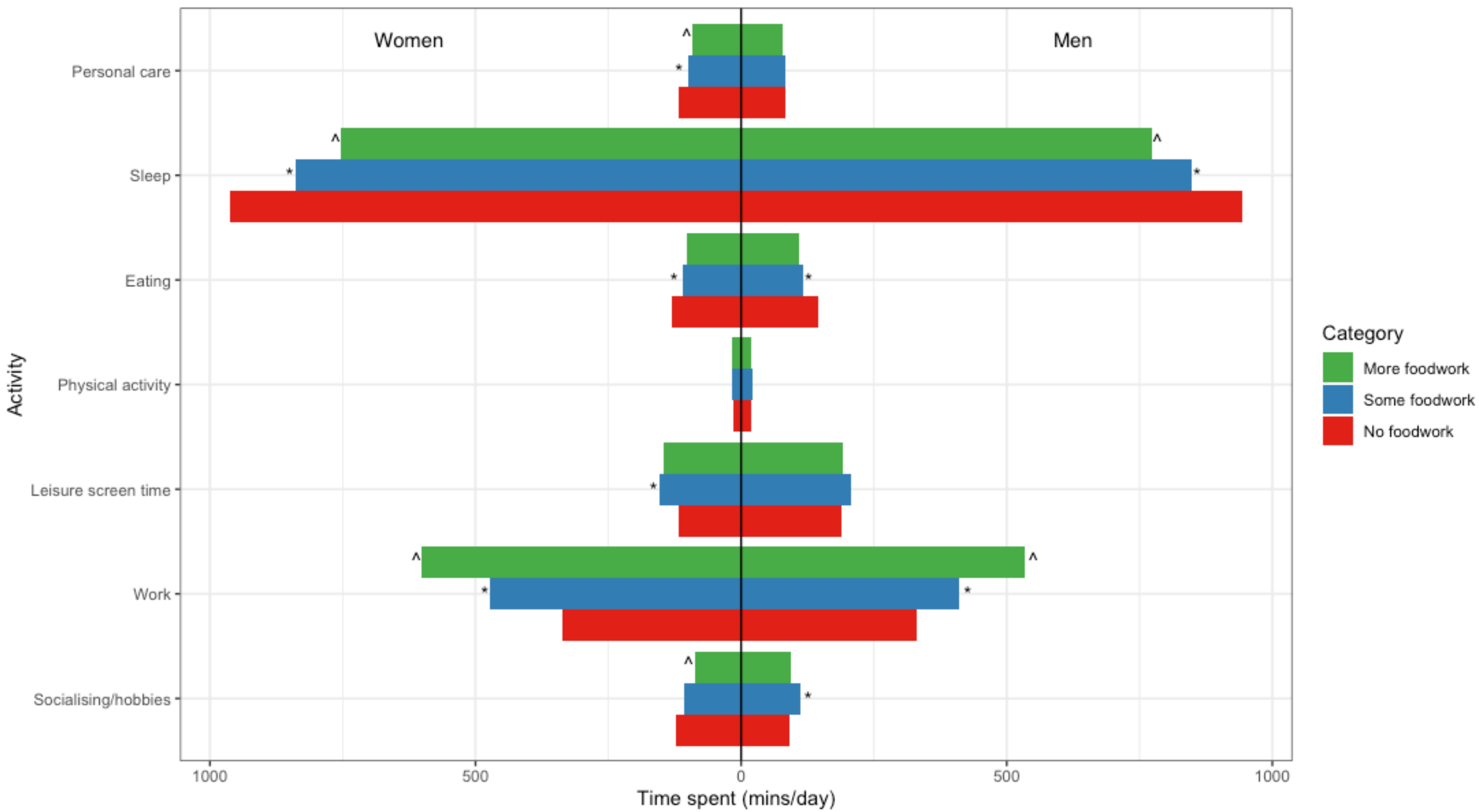
A statistically significant interaction ($p<0.017$) was found for gender and economic activity in the association between foodwork and time-use composition, but not for the presence of children in the household.

Where I found a statistically significant interaction, I performed a stratified analysis, estimating model-adjusted compositional means for each part of the composition and comparing foodwork categories with each population subgroup. The results of these stratified analyses are presented in Figures 7 and 8.

Figure 7 shows that women who did more foodwork spent less time on personal care and socialising and hobbies, which was not the case for men. Further, while both men and women who did more foodwork spent more time on work overall, women in all foodwork categories spent more time on work. This difference was smaller, at 6 minutes, between men and women who did no foodwork, but larger, at 53 minutes, between men and women who did more foodwork (see Appendix 2).

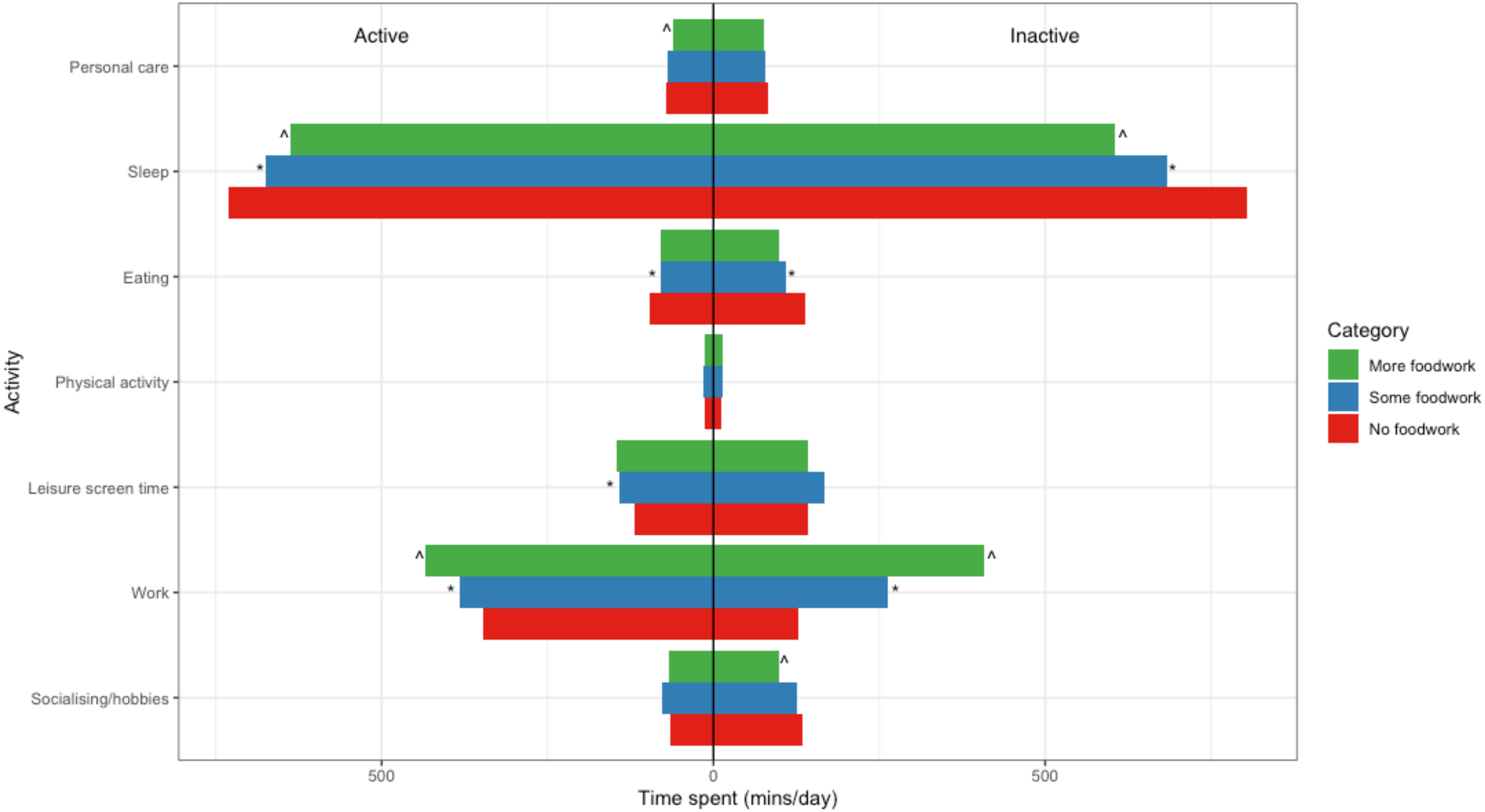
Figure 8 shows that both economically active and inactive participants spent more time on work in the higher foodwork categories. Economically active participants spent more time on work overall, as expected. However, the difference between economically active and inactive participants narrowed with increasing time spent on foodwork: in the no foodwork category, economically active participants spent 220 minutes more on work than economically inactive participants, while in the *more* foodwork category, economically active participants spent only 27 minutes more on work than their economically inactive counterparts. This can be attributed to more substantial increases in time spent on work in higher foodwork categories among those who are economically active. Meanwhile, while participants in higher foodwork categories spent less time on sleep regardless of whether they were economically active or inactive, economically inactive participants decreased time allocated to sleep more substantially as foodwork category increased. Economically inactive participants who did more foodwork spent less time on socialising and hobbies than their counterparts who did less foodwork, which was not true among economically active participants. Meanwhile, economically active participants who did more foodwork spent less time on personal care.

Figure 7 Model-adjusted[a] compositional means for men and women by foodwork category (n=5878)



[a]Adjusted for age, gender, employment status, education, occupation, presence of children and diary day type
^ Statistically significant log-ratio difference between more and some foodwork for this part
*Statistically significant log-ratio difference between some and no foodwork for this part

Figure 8 Model-adjusted[a] compositional means for economically active and inactive participants by foodwork category (n=5857)



[a]Adjusted for age, gender, employment status, education, occupation, presence of children and diary day type
^ Statistically significant log-ratio difference between more and some foodwork for this part
*Statistically significant log-ratio difference between some and no foodwork for this part

3.5 Discussion

3.5.1 Statement of principal findings

The foodwork categories revealed demographic differences in different allocations of time to foodwork. The more foodwork category was dominated by women, while the no foodwork category was dominated by men, representing gendered differences in responsibility for foodwork. Economically inactive participants were also over-represented in the more foodwork category relative to economically active participants. There was some indication that participants who were more educated or in professional and managerial occupations were over-represented in the some foodwork category, while participants who were less educated or in routine and semi-routine roles were over-represented in the none or more foodwork categories.

As amount of foodwork increased, more time was spent on work (a part which includes foodwork, but also all other forms of work, both paid and unpaid), while time spent on sleep decreased. While the inclusion of foodwork in work may go some way to explaining the difference in time spent on work, differences are larger (77 minutes between some and no foodwork groups, and 103 between the more and some foodwork groups, see Appendix 2) than between-group differences in median time spent on foodwork (30 and 80 minutes between the same groups, see Table 5).

The findings varied by gender. Women who did more foodwork spent less time on personal care and socialising and hobbies, which was not the case for men. Further, while both men and women who did more foodwork spent more time on work overall, women in all foodwork categories spent more time on work than their male counterparts. As time allocated to foodwork increased, this difference also increased, from 6 minutes between men and women who did no foodwork to 53 minutes between men and women who did more foodwork (see Appendix 2).

The findings also varied by economic activity. Both economically active and inactive participants spent more time on work in the higher foodwork categories. Economically active participants spent more time on work, as expected. However, the difference between economically active and inactive participants narrowed with increasing time spent on foodwork: in the no foodwork category, economically active participants spent 220 minutes more on work than economically inactive participants, while in the more foodwork category, economically active participants spent only 27 minutes more on work than their economically inactive counterparts (see Appendix 2). This can be attributed to more substantial increases in time spent on work in higher foodwork categories among those who are economically inactive.

3.5.2 Strengths and weaknesses of the study

To my knowledge, this study represents the first analysis of the relationship between foodwork level and overall daily time use. This study employs an analytic method that recognises the interdependence between different activities, considering foodwork alongside other activities which also contribute to health and wellbeing. Nevertheless, I recognise that this is a schematic representation of daily activities. For example, some 'work' may be experienced as leisure, as, for example, many individuals report enjoying and finding creativity in foodwork.[16,179,180]

By using elements of time use as both exposure and outcome, there will necessarily be inter-group differences in time use. Because of my wish to look at the 24-hour time budget as a composition, it was impossible to draw out time spent on foodwork and examine the remaining time in isolation, as among those who engaged in foodwork the rest of their time would not add up to 24 hours. Foodwork had to be included, and went into the 'work' part. However, I can comment that foodwork (median 70 minutes/day) made up a relatively small part of time spent on all work, and that differences in daily time use between foodwork groups were seen in many parts other than work.

Importantly, this study was cross-sectional and can only tell us how groups who do more or less foodwork differ in their use of time. Longitudinal analysis would be required to determine how increasing time spent on foodwork, as a result of, for example, a cooking or food skills intervention, impacted the rest of the time-use budget.

This study uses self-reported data on daily activities. However, currently objective data of this sort (e.g. from a wearable camera) is not available in such a large data set. Further, data from time-use diaries has been shown to be less liable to over- and under-reporting than questions about a specific activity, as participants must fit all daily activities into a 24-hour period.[166] Finally, validation studies using wearable cameras and accelerometers suggest time use diaries are reasonably reliable.[166]

In order to define a time-use composition made up of exhaustive and mutually exclusive parts, this analysis focused on primary activities only. While foodwork was mostly listed as a primary activity rather than a secondary one, other activities, such as eating or screen time, often featured as secondary activities. Further, time-use diaries principally tell us about substantive uses of time. In the case of foodwork in particular, there is a substantial amount of intellectual labour that goes into planning and managing a household's food supplies and meals,[16,82,86,142] much of which may occur simultaneously alongside other tasks or in a very fragmented way, making participants less likely to enter it into a time-use diary.

Finally, while time spent on foodwork has been shown to be associated with diet quality,[138] there are lots of other factors that could moderate the relationship between food practices and the healthfulness of the resulting foods, such as ingredients, kitchen equipment, cuisine or skill.

3.5.3 Comparison with previous work

To my knowledge, this is the only analysis that has examined the association between foodwork and time-use. However, many studies have found that people feel they lack the time to prepare meals at home as often as they would like.[80,82,83,141–144] As noted above, some of the experience of time may not be captured by time-use diaries, but this analysis gives us some insight into how foodwork interacts with one dimension of the experience of time: the substantive uses of time such as work or leisure.

Our findings are consistent with other work which suggests that women do more foodwork, as well as other types of housework.[142,181,182] The larger amount of time women spent working compared to men, while not a key finding, is in line with the consensus that, while women are increasingly in paid employment, they continue to do more than their share of work in the home.[174] This is of interest to my analysis in considering how, compared to men, women might structure their time differently in order to accommodate the work they do.

In existing research, participants who are more likely to experience time scarcity such as single parents or working parents report lower frequency of preparing meals at home.[83,141,143] In contrast, in this analysis adults who lived in households with children were not over-represented in the lower foodwork categories, nor was the presence of a child in the house a significant modifier of the association between foodwork and time use. This discrepancy could be further explored in this data set by looking at episodes of home food preparation. A more differentiated measure of household structure might also be useful.

3.5.4 Meaning of the study: possible mechanisms and implications for practice and research

These findings do not suggest that doing more foodwork is associated with less time spent on just one single activity. Instead, the structure of a 24-hour time budget varied extensively across several compositional parts between participants who devoted no, some and more time to foodwork, and these differences varied by socio-demographic characteristics.

Our analysis included several activities with important repercussions for physical health, namely sleep, physical activity and leisure screen time (a discretionary sedentary activity).[183] The most pronounced difference was in time spent on sleep, with individuals who did more foodwork spending substantially less time sleeping in the whole sample and across all population sub-groups. Given the use of the compositional mean as an indicator of time spent sleeping in this analysis, as well as the inclusion of daytime naps and time spent in bed not sleeping in the measure, it is difficult to compare sleep time across different foodwork categories to recommendations for a healthy amount of sleep, with both low and high amounts of sleep being detrimental to health.[184] However, an analysis of sleep in this sample using more conventional statistical methods concluded that the (arithmetic) mean time spent sleeping was around 8 hours, which is in the recommended range, suggesting an epidemic of oversleeping in this sample may be unlikely.[167] Given this, these results may suggest a less health-promoting pattern of sleep is associated with increased foodwork. It is plausible that sleeps acts as a 'time reservoir', from which time can be drawn to accommodate other activities, as has been found in studies on time use and physical activity.[151,185] Longitudinal work would be required to test this hypothesis. However, the limitations of time-use diaries may also need to be considered here, as it is possible that some time recorded as sleep or time in bed with no distractions might in reality be time spent reading or on screens that participants have not made a note of.

In the whole sample, I found that time spent on work was significantly higher in participants who spent more time on foodwork. However, in stratifying by economic activity, I found that time spent on work increased more substantially among economically inactive participants who did more foodwork than among economically active participants. Economically active participants were also under-represented in the more foodwork group, and unsurprisingly spent more time on work overall than those who were economically inactive. This may suggest that there is a limit to how much time participants are willing or able to spend working, whether this work is paid or unpaid. Previous scholarship had discussed the interaction between available time and available income, suggesting that these two resources must be allocated in complementary ways: individuals who are more 'time-poor' may buy their way out of certain kinds of unpaid labour, such as working parents who pay for childcare.[132,133] Existing studies suggest this is true of foodwork: increased workforce participation and labour market hours worked by household managers (often women) are associated with increased frequency of consumption of pre-prepared meals, as well as increased expenditure on out of home food, often driving up overall food expenditure.[186–188] This may lead to health inequalities. While home food preparation is often advocated as an inexpensive strategy to eat healthily,[76] in some households adults are employed but earning a small salary, i.e. time and income poverty coexist, meaning that increasing home food preparation may be difficult. Given the increased financial costs associated with eating a healthier diet,[189] these households may struggle to access healthy diets.

Our findings suggest that gender continues to play a significant role in how foodwork is allocated. The more foodwork category was dominated by women, while the 'no' foodwork category was dominated by men. Further, women's time allocation differed more substantially than men's in association with their foodwork category: if they did more foodwork, their overall work time increased more substantially, and they spent less time on personal care and socialising and hobbies. Past research suggests that even in households where the idea of foodwork, and domestic work more broadly, as 'women's work' is not explicitly endorsed, household members present alternative narratives to rationalise this unequal division of labour.[142] One such narrative is centred around health and budgeting: that, in heterosexual couples at least, women feel that if they left their partners to prepare meals they would produce something less healthy or spend too much money.[142] As household gatekeepers they therefore feel obliged to take on the task themselves. These differences in the substantive use of time may mask further inequality in the intellectual labour implicit in foodwork: Cairns and Johnston discuss how their female participants would sometimes ask their (male) partners to go to the supermarket, but would often do substantive framing of this task themselves, preparing a list, shortening the list to only the items urgently required, and providing extensive instructions on the exact type of product required.[179] Practitioners who advocate or intervene to increase home food preparation must be careful to critically engage with gendered ideas around both foodwork and responsibility for household health and budgets.

Evidence suggests that eating more home-prepared food is associated with higher diet quality, and that more time spent on home food preparation is associated with increased dietary quality.[138] While this cross-sectional analysis explores how participants who do more foodwork allocate their time differently than those who do less, it is not clear that these patterns would be replicated in the case of an individual increasing time spent on foodwork as a result of a home food preparation intervention. Further work is required to determine what the effects on time use of such an intervention might be, and whether there are unintended consequences such as health detriments due to a loss of time spent sleeping, an uneven allocation of this additional time between the genders, or a reduced effect for some individuals and households due to time and income poverty.

3.6 Conclusion

In conclusion, I found that time use varied extensively between participants who did more or less foodwork. In particular, participants who spent more time on foodwork spent substantially less time sleeping, as well as less time on eating, socialising and hobbies, while spending more time on work, both paid and unpaid. This may have repercussions for physical health as well as broader dimensions of wellbeing.

Gender emerged as an important structuring factor in foodwork and time-use. Women were over-represented in the category of participants doing 'more' foodwork. In contrast to men, women who did 'more' foodwork spent less time on personal care, socialising and hobbies.

While further work examining how time use changes as a result of a home food preparation intervention is certainly important, those who seek to encourage more home food preparation should be aware of the associations between time spent on foodwork and time spent on other activities, and ensure their interventions guard against potential unintended, unwanted consequences.

4 MEASURING THE CONSUMPTION OF HOME-PREPARED FOOD

4.1 Overview

This chapter presents a food diary-based measure of home-prepared food consumption that was developed for use with the UK National Diet and Nutrition Survey. It compares this measure to a measure that is more conventionally used in the literature, frequency of at-home meal preparation in participants' households, to determine whether the constructs measured by both are similar and aid in interpreting the findings of Chapter 5 and 6, where the food diary-based measure is deployed, in the context of existing research, which has predominantly relied on self-reported frequency of at-home meal preparation. It also determines whether the association between the measures varies between socio-demographic groups, further aiding in comparison to existing work and contributing to understanding whether work that relies on self-reported frequency of home food preparation might be subject to bias owing to systematic differences in the interpretation of this construct between different socio-demographic groups.

4.2 Introduction

While the first half of this thesis focused on foodwork, and the way in which foodwork, or at least some of the domains of foodwork, fits in with other daily activities and tasks, the second half will focus on home-prepared food (HPF) and its association with, and necessity for, dietary quality. As discussed in Chapter 1, there is a distinction to be made between the work involved in accessing and preparing foods, and the foods that result from this work. Not all foodwork produces food that would generally be defined as home prepared. In the time use diaries used in Chapters 2 and 3, time coded as being spent on 'food preparation and management' could represent the creation of a 'home-prepared' meal, but it could also represent the heating of frozen or refrigerated ready meals or meal components, or the serving of store-bought bread, cheese, cured meat or dips. Most would argue that these meals are not home prepared. 'Home food preparation' does not merely mean doing foodwork, but is a specification about the sort of foodwork that must be done to create HPF. 'Home-prepared' or 'home-cooked' food is then a subset of the food that results from foodwork broadly defined.

Determining the association between HPF consumption and other variables, including dietary intake and quality, requires the measurement of levels of consumption of HPF, which in turn relies upon having an understanding of what HPF is. As discussed in Chapter 1 (1.3 Foodwork and home-prepared food: definitions, measurement and evidence), this is not a straightforward proposal, and defining HPF remains contentious. Past research has relied on participants to self-define what constitutes home food preparation and HPF in order to estimate levels of consumption, asking participants about the frequency with which they prepare[49,54–60] or eat[50,61] 'home-prepared' or 'home-cooked' meals.

This approach has certain advantages, as it avoids being prescriptive about what constitutes HPF and takes into account people's experiences of preparing food at home.

However, as discussed in Chapter 1, it is unclear that a common consensus on what HPF means exists in the general population, not to mention in academic research on the topic.[45,80] People have different ideas about what counts as home food preparation or cooking, and what kinds of ingredients might be included in a home-prepared or home-cooked dish.[45,80] This may present problems in trying to determine the extent to which HPF consumption is important for diet quality, particularly if the definition of HPF varies systematically between groups that have different eating practices, dietary intake and quality, and health outcomes.

Further, some qualitative work suggests that, while people have different definitions of what HPF means, home food preparation is an aspirational food practice for most.[80] There is a risk of conflating food that is 'home-prepared' with food that is 'healthy', another quality of food to which many aspire. This conflation may happen within lay understandings of home food preparation, but also often seems implicit in research on the issue. For example, one study attempting to quantify HPF consumption using ecological momentary assessment specified what was meant by 'homemade/freshly prepared foods' by adding a note to participants to include 'fresh fruits and vegetables' in this category.[61] While fresh fruit is certainly minimally processed and encouraged as part of a healthier diet, many types of fruit are commonly eaten without any need for preparation, such as bananas, oranges, or apples. However, it is not clear whether this conflation also occurs in lay understandings, or whether it is likely to bias findings. In fact, some qualitative research highlights that, in certain communities at least, there are concerns around 'home cooking', with the foods traditionally cooked by parents and grandparents being loved, but also, for the most part, avoided, as not healthy enough for regular consumption.[86]

Developing a measure of HPF consumption that is determined a priori and centred around home food preparation practices and the meals and foods that result from them requires defining HPF in a way that is relatively subjective, even if grounded in existing literature on the topic of home food preparation. However, it also has the advantage of being internally consistent across participants, being objectively applied to their food diary data without relying on their subjective interpretations of what home-prepared means. Further, by requiring the researcher to clearly define what is meant by HPF, it allows me to differentiate between HPF and other related constructs, such as foods cooked 'from scratch' or made from minimally processed ingredients.

Finally, a measure of HPF consumption that relies on food diaries as opposed to questions about the frequency of preparing or eating home-cooked meals has a practical use. In dietary surveys where detailed food diaries have been completed by participants, but where no questions about home food preparation have been asked, it would still be possible to gain an understanding of the levels of HPF consumption in the sample. This was the case in the UK National Diet and Nutrition Survey (NDNS), where the first wave of data collection (2008-2009) included a question on the frequency of preparing meals at home, but this question was dropped in the latter years of the survey.

It is difficult to 'validate' one measure of home-prepared food consumption against another. Unlike in the measurement of, for example, dietary intake, where dietary surveys can be validated against a gold standard of doubly labelled water,[190] or in the measure of time use, where time use diaries can be validated using wearable cameras,[166] there is no gold standard measure of home-prepared food consumption. While self-reported frequency of home food preparation or consumption has generally been used as a measure, studies that use it report the fact that there is a lack of clarity around what home-prepared food is, or how participants might interpret it, as a limitation.[67]

Further, it is not clear that questions around frequency necessarily get at the same concept as a food diary-based measure of consumption. First, many studies, including NDNS, only ask about whether the 'main' meal of the day (or, in some studies, about 'dinner'[67]) was home prepared. While the main meal of the day may be the most important contributor to home-prepared food consumption, such questions may also omit some home-prepared food. Second, while some studies have asked about frequency of *consuming* home-prepared meals,[191] many, including NDNS, ask instead about frequency of preparation, which may not take into account all of the home-prepared meals which are consumed. Where dietary intake and quality are the outcomes of interest, this may present some problems. Third, meals defined by participants as home-prepared may be composed of elements that are both home-prepared and not, such as a home-prepared soup and store-bought roll, or home-prepared meat and vegetables with frozen chips or Yorkshire puddings. It is not clear, either from the participants' or the researchers' point of view, at what threshold of home-prepared food items a meal becomes 'home-prepared' overall. Finally, as discussed above, participants may have different ideas about what constitutes home-prepared food, which may not align with those of other participants or those of researchers.

However, the existence of both a measure of self-reported at-home meal preparation and a food diary-based estimate of energy derived from HPF in the first wave of the NDNS sample allows me to compare the two. Understanding whether estimates derived from the food diary-based measure are associated with the more conventional measure will be helpful in interpreting my own findings in Chapters 5 and 6 in the light of existing research, which largely relies on self-reported frequency of preparation or consumption. Further, determining whether this association varies systematically between different socio-demographic group will also be helpful in this regard, as well as offering insight into whether these groups have systematically different definitions of at-home meal preparation, which could introduce bias into existing research on socio-demographic variation in home food preparation practice and related outcomes. While existing research suggests definitions of home food preparation are variable,[45,80] it is not clear whether they vary systematically between groups in a way that presents problems for epidemiological study.

Thus, the aims of this chapter are:

1. To present the methods underpinning a food diary-based measure of HPF consumption, which in Chapters 5 and 6 will be used to explore HPF in the whole NDNS sample;
2. To compare this measure with a more orthodox measure, frequency of at-home meal preparation in participants' households, to determine whether the constructs measured by both are similar; and
3. To determine whether the association between the measures varies between socio-demographic groups.

4.3 Methods

I conducted a cross-sectional analysis of data from the UK NDNS Wave 1, 2008-2009, obtained from the UK Data Archive.[192]

4.3.1 Data source

This analysis relies on data from detailed food diaries and individual questionnaires collected as a part of NDNS. NDNS is an annual cross-sectional survey which collects information on food consumption and nutritional and health status of free-living individuals in the UK. A detailed account of the NDNS recruitment and sampling protocol has been published elsewhere.[193] NDNS was approved by the Oxfordshire Research Ethics Committee and written informed consent was obtained from all participants.

In Wave 1 (2008-2009), a series of questions on home food preparation skills and behaviours, including the frequency of preparing main meals, were included in the individual questionnaires.

In participating households, up to one adult and one child were included as respondents, and asked to complete food diaries and questionnaires. As part of the data collection process, the NDNS study team also identified the main food provider (MFP) in all participating households. The MFP is the household member that takes the main responsibility for food shopping and preparation. Where these tasks were shared equally between more than one household member, one of these was randomly selected as the MFP by the NDNS team. The MFP can be an NDNS respondent, and often is, meaning that in many cases the NDNS respondent and the MFP are the same person. In Wave 1, MFPs as well as adult NDNS participants were asked to respond to the questions around home food preparation skills and behaviours.

4.3.2 Inclusion criteria

Participants from Wave 1 of NDNS were included in this analysis if they were aged 19 or over, had completed an individual questionnaire and valid food diary (as defined by the NDNS study team, having completed 3 or 4 days of the diary), and if the MFP in their household (whether this was themselves or someone other than themselves) had also responded to the question about the frequency of preparing a main meal at home.

4.3.3 Consumption of energy from home-prepared food

Definitions of ‘cooking’ have been discussed extensively and remain contested,[26,45,139,194] with many definitions not deeming the application of heat to be a necessary part of this process.[45,110] As a result ‘home food preparation’ and ‘home-prepared food’ seem more accurate and are the concepts deployed here. Different, but related, conceptualisations exist, such as food ‘prepared from scratch’[65] or food that is not ‘from outside the home’. The conceptualisation of HPF used here reflects several conceptions of ‘cooking’, or home food preparation, drawn from qualitative studies[26,195] as well as behaviours which are habitually enquired about in studies of ‘cooking’, such as blending, mixing, boiling, chopping, roasting and pan frying.[81] From this conceptualisation of home food preparation, as a set of behaviours, I defined foods which I would deem to be home-prepared as being the products of these behaviours.

For each participant, the proportion of energy derived from HPF was estimated using information from food diaries. Participants completed unweighed 4-day food diaries, including all food and beverages consumed both inside and outside the home. This process is described in detail in the NDNS study materials.[196] Participants also recorded where the food was eaten, for example at home, in a restaurant or café, or at work. This location variable included a specific category for food eaten at work but brought from home.

Food items listed in food diaries were classified as either requiring or not requiring home preparation. All foods were classified as home-prepared except those listed in Table 6. Foods which should not be classified as being home-prepared were decided by the authors *a priori*.

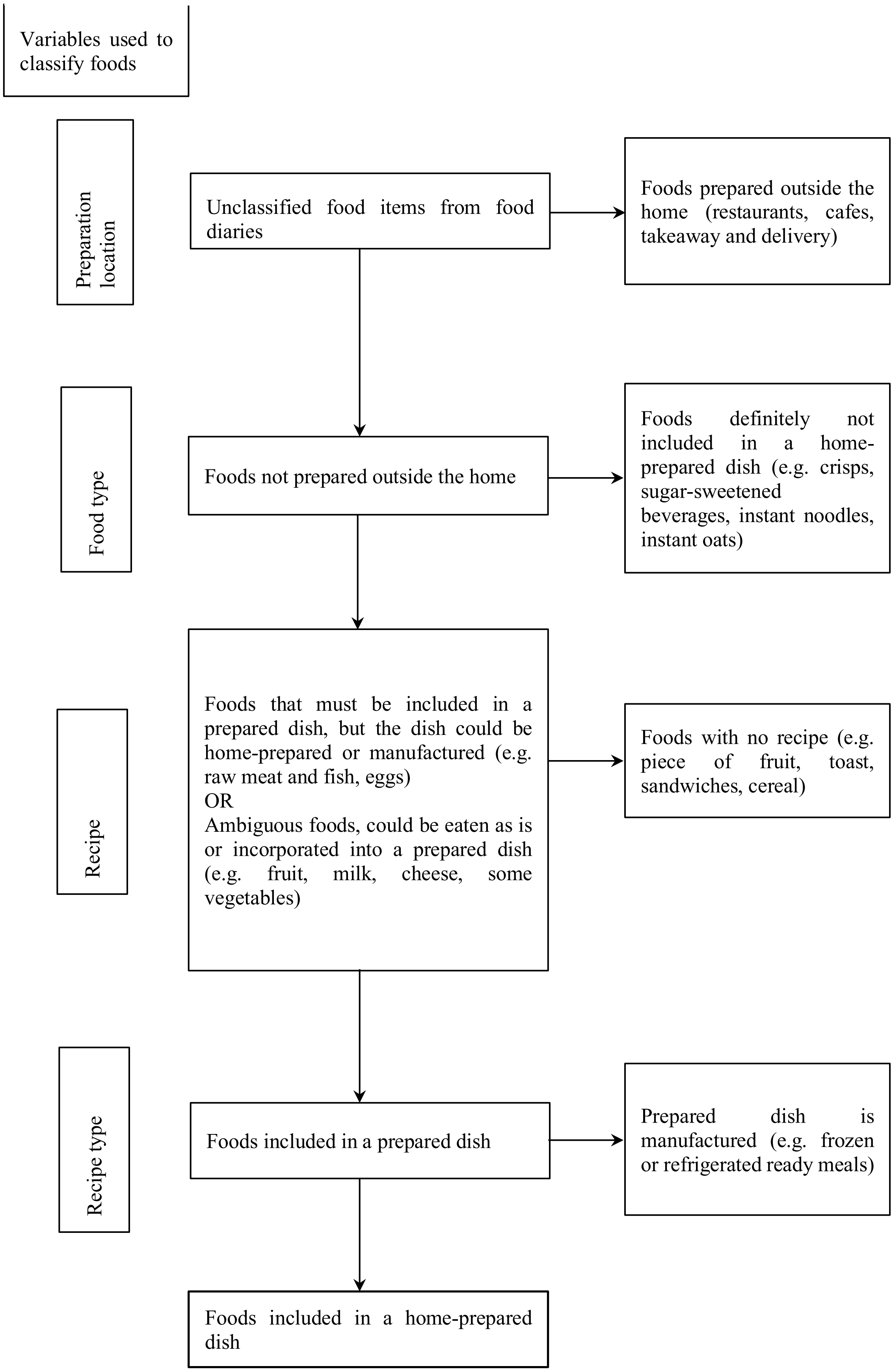
Table 6 Foods not classified as home-prepared

Foods prepared and eaten outside the home (e.g. food eaten in a restaurant or café
Foods prepared outside the home and eaten in the home (e.g. takeaway and delivery foods)
Foods eaten as purchased (e.g. crisps, sweets, granola bars, juice and soft drinks, store-bought sandwiches, yoghurt, prepared and whole pieces of fruit)
Foods requiring the application of heat or the addition of hot water, but no other preparation (e.g. frozen and refrigerated ready meals, tinned soups, instant noodles, instant oats)
Foods involving the combination of several components, but each component required minimal preparation (e.g. a bowl of cereal, a ham or cheese sandwich)

Food classification was carried out using food diary variables as illustrated in Figure 9, with foods which were not classified as home-prepared being successively removed until only HPF remained. NDNS food diary data is available in a long format, with each food item consumed by each participant as part of a distinct eating occasion listed as an observation. To each of these observations, a preparation location, food item type, and recipe is attributed, which were used to determine which foods matched my definition of home-prepared. Foods that were not consumed as part of a recipe are not attributed a recipe. Thus, for example, milk could be listed as a food item. If the milk were consumed as a beverage, no recipe would be attributed (the recipe variable would simply list the food item again). If the milk were consumed as part of an omelette, the value for the food item variable would still be milk, while the value for the recipe variable would be ‘egg and egg dishes’. Within the recipe variable, recipes are listed as either manufactured or home-prepared. Therefore, a food item such as pork is generally included in a recipe, but if this recipe is manufactured (such as a store-bought pork pie), the value in the recipe variable would be ‘pork and pork dishes, manufactured’, meaning the food item (and its energetic content) would be excluded from energy from home-prepared food.

The proportion of energy from HPF was then calculated for each participant by summing the energetic content of foods classified as home-prepared and dividing that value by the participant’s total energy intake. This was modelled as a continuous variable: proportion of energy intake from HPF per participant.

Figure 9 Flow diagram for classification of foods as being home-prepared



4.3.4 Frequency of main meal preparation by household main food provider

Frequency of main meal preparation by household MFP was determined by asking the household MFP: "How often do you prepare a main meal for yourself or others?". This was thought to be a better proxy for consumption of home-prepared meals than the individual's response to this question in cases where the NDNS participant in a given household was not their household MFP.

Response categories were never; only for special occasions; less than once a week; one or two days a week; some days (3-4 a week); most days (5-6 a week); or every day. Due to the distribution of responses, which was heavily weighted towards more frequent home food preparation, the response categories representing lower frequencies were collapsed, meaning that this analysis differentiated between four categories: twice a week or less; some days (3-4 a week); most day (5-6 a week); and every day.

4.3.5 Other variables of interest

Other variables of interest were age, gender, presence of children in the household (no children under the age of 16 at home; children under the age of 16 at home; or children under the age of 5 at home), education, household income equivalised for household composition[197] (described in quintiles, from lowest to highest), and occupational social group (National Statistics Socio-Economic Classification (NS-SEC), collapsed into three groups: routine and manual; intermediate; or professional and managerial occupations)[178]. These variables were included as covariates in adjusted models, as well serving as interaction terms.

4.3.6 Analysis

I described the sample characteristics, along with proportion of energy from HPF, for the whole sample and by frequency of at-home main meal preparation by the household MFP.

I used linear regression, both unadjusted and adjusted for all covariates, to explore the association between frequency of home food preparation by the MFP in the participant's household ('exposure' variable) and proportion of energy derived from HPF for the participant ('outcome' variable). Interaction terms were introduced to determine whether the association between the two measures differed systematically between population sub-groups. Where the interaction term was statistically significant ($p<0.05$), stratified analyses were performed.

Analyses were weighted using weights provided by the NDNS study team, which sought to mitigate bias resulting from the survey design and from differential non-response across population sub-groups.[198]

4.4 Results

4.4.1 Sample characteristics

In Wave 1 of NDNS, 801 participants aged 19 or over provided valid food diaries and completed individual interviews. Of these, 774 lived in households where the MFP (the participant themselves or another household member) had responded to the question about the frequency of preparing a main meal at home. These participants were included in this analysis.

Of these, 596 participants were the MFPs in their household, while 178 participants were not the MFPs in their household.

Sample characteristics are described in Table 7. Proportion of energy derived from HPF was relatively low overall, at around 27.3% of total energy. It increased with increased weekly frequency of household MFP preparing a main meal at home: participants who lived in a household where the MFP prepared a main meal at home less than twice a week derived 18.2% of their energy from HPF, while participants who lived in a household where the MFP prepared a main meal at home every day derived 28.5% of their energy from HPF.

The sample characteristics are presented in terms of four categories of frequency of main meal preparation by household MFP in order to provide a more detailed picture of how proportion of energy from HPF varies across these categories. However, the small number of participants in the lower frequency categories means the results for these categories may be more subject to random error, potentially making estimates less representative of these groups in the population.

Table 7 Characteristics of the analytic sample by weekly frequency of main meal preparation by household MFP (weighted, n=774)

Proportion (%)	Household MFP prepares a main evening meal (per week)				Total
	2 days or less	Some days (3-4)	Most days (5-6)	Every day	
Total	2.8	10.1	16.1	71.0	100.0
Energy from HPF (%, mean (95% CI))	18.2 (14.8, 21.6)	24.4 (20.7, 28.1)	25.1 (22.2, 28.0)	28.5 (27.3, 29.7)	27.3 (26.1, 28.4)
Age (years, mean (95% CI))	54.8 (44.2, 65.3)	40.5 (35.5, 45.6)	46.0 (41.6, 50.4)	49.1 (47.1, 51.1)	47.9 (46.1, 49.7)
Gender					
Men	40.4	41.5	47.7	46.9	46.3
Women	59.6	58.5	52.2	53.1	53.7
Children in household					
None	85.8	71.5	75.6	64.3	67.5
Under the age of 16	14.2	13.4	18.4	19.4	18.5
Under the age of 5	0.0	15.0	6.0	16.2	14.0
Education					
Degree or higher	14.9	32.5	31.1	21.1	23.6
A-level or higher	15.3	20.5	29.2	29.1	27.9
GCSE or equivalent	36.9	24.7	21.4	23.7	23.8
No qualifications	32.9	22.3	18.2	26.1	24.7
Income quintile					
Highest	15.2	25.0	33.9	15.3	19.3
2	25.8	16.5	15.9	23.2	21.4
3	23.6	27.5	19.2	16.6	18.3
4	20.7	9.5	19.9	27.4	24.2
Lowest	14.7	21.6	11.0	17.5	16.7
Occupational grade					
Managerial or administrative	16.1	41.6	45.6	41.6	41.5
Intermediate	45.4	20.2	30.0	36.5	34.1
Routine and manual	38.5	38.2	24.3	21.9	24.4

4.4.2 Association between frequency of main meal preparation by main food provider and proportion of energy from home-prepared food

Table 8 presents the results of two linear regression models (unadjusted and adjusted for all covariates) between the frequency of at-home main meal preparation by the household MFP and the proportion of energy derived from HPF. Compared to participants living in households where the MFP prepared main meals at home twice a week or less, participants living in household where the MFP prepared main meals at home every day derived 6.7% more of their energy from HPF after adjusting for covariates.

When socio-demographic variables were introduced as interaction terms, none were found to be statistically significant effect modifiers of the association ($p<0.05$).

Table 8 Unadjusted and adjusted associations between frequency of at-home main meal preparation by MFP and proportion of energy from HPF (weighted, n=774)

Frequency of at-home main meal preparation by household MFP (per week)	Proportion of energy from HPF (%) Regression coefficient (95% confidence intervals) Unadjusted	Adjusted[1]
2 days or less (ref.)		
Some days (3-4)	5.1 (0.6, 9.6)	4.0 (-1.2, 9.2)
Most days (5-6)	5.7 (1.4, 9.9)	4.5 (-0.5, 9.5)
Every day	7.7 (3.8, 11.6)	6.7 (2.0, 11.2)

[1]Adjusted for age, gender, presence of children in household, education, income quintile and occupational class

4.5 Discussion

4.5.1 Statement of principal findings

Participants living in a household where the MFP prepared the main meal at home every day derived 6.7% more of their energy from home-prepared food compared to participants living in a household where the MFP prepared the main meal at home two days a week or less. After adjusting for covariates, participants recording intermediate frequencies of at-home meal preparation by the household MFP (some days or most days) did not differ significantly in terms of their proportion of energy from HPF compared to participants living in a household where the MFP prepared the main meal at home two days a week or less. However, this could plausibly be due to a lack of power, as 71% of the analytic sample reported at-home main meal preparation in their households every day, and relatively small numbers fell into the other frequency categories. A non-parametric test for trend (conducted post-hoc) in proportion of energy from home-prepared food by self-reported frequency of at-home main meal preparation by household MFP suggested an upward trend with increased frequency ($z=4.35$, $p<0.001$).

This association did not vary significantly by any of the socio-demographic factors considered here.

4.5.2 Strengths and weaknesses of the study

This study uses data from a sample that is representative of the adult population of the UK. It provides a comparison between a food diary-based measure of home-prepared food consumption, which has been used in Chapters 5 and 6 to explore home-prepared food consumption in the entire NDNS sample, and a measure of self-reported frequency of at-home main meal preparation by the household MFP, which bears more similarity to conventional epidemiological and quantitative approaches to measuring home-prepared food consumption, which largely rely on self-reported frequency of making or consuming home-prepared meals. To my knowledge, this is the first such comparison to have been undertaken and provides useful context for interpreting the findings presented in Chapters 5 and 6 in light of the existing literature.

The first wave of NDNS data, used here, is now between 11 and 12 years old, meaning that these results may be somewhat out of date. It is not clear whether definitions of home food preparation may have changed in the intervening years. However, the measure developed here allowed me to explore HPF consumption in the complete NDNS sample to date, which includes both a larger number of participants and more recently collected data. The results of these analyses are presented in Chapters 5 and 6.

4.5.3 Comparison with previous work

To my knowledge, this is the first analysis to have developed a measure of HPF consumption based on food diaries, and to have compared this measure to a more conventional measure of HPF consumption (self-reported frequency of meal preparation).

4.5.4 Interpretation and future work

As discussed in the introduction to this chapter, as well as in Chapter 1, different approaches to measure home food preparation and the consumption of HPF have different strengths and weaknesses. While insight can be gleaned from different approaches to measurement, the approach developed here allows for higher granularity when it comes to estimating HPF consumption. For example, it accommodates meals that are composed of a combination of foods, some of which are home-prepared and some of which are not. It also emphasises the relatively low proportion of energy from HPF, highlighting the importance of foods that are not home-prepared to dietary intake and quality. This idea is further discussed in the subsequent chapters.

As discussed in the introduction, the idea of 'validation' is a difficult one to apply in the measurement of home-prepared food consumption, as the definition of home-prepared food remains contested and it is difficult to identify a 'gold standard' of measurement. While frequency of preparing meals at home has often been measured (which may be useful in capturing associations between home food preparation and health outcomes that do not operate via dietary intake), Mills and colleagues commented on the importance of measuring *consumption* of home-prepared meals in terms of developing a better understanding of the specific association between home prepared food, dietary intake and related health outcomes.[191] While frequency of at-home main meal preparation by the household MFP was selected as being the best proxy for consumption of home-prepared food available in the NDNS data, this approach is still subject to some of the limitations discussed in the introduction to this chapter, with a lack of clarity around what home food preparation is and the possibility (supported by qualitative studies[26,45,80]) that definitions of home food preparation are highly variable in the general population, even within a single national context.

However, while this study does not provide a 'validation' of the food diary-based measure, the fact that energy from home-prepared food increases with more frequent self-reported at-home meal preparation suggests that the two measures are assessing a related construct. While a difference of 6.7% of energy from home-prepared food between participants whose household MFP prepares a main meal at home every day and those whose household MFP prepares a main meal at home two days a week or less seems modest, it remains equivalent to around a quarter of mean energy intake from home-prepared food across the sample. The findings from the studies presented in Chapters 5 and 6, which deploy the food diary-based measure, may therefore be reasonably compared to previous findings on home food preparation and diet quality, while keeping in mind some of the nuances discussed in the introduction of this chapter and in Chapter 1 with regard to meals being composed of foods that are both home-prepared and not.

Further, as socio-demographic variables did not act as significant effect modifiers in this association, these results do not provide evidence for bias in existing literature stemming from definitions of home food preparation that are systematically different between different groups, at least with regard to my definition of home-prepared food.

This approach to measuring HPF consumption was developed by researchers based in the UK, using food categories from a UK-based dietary survey, and guided by academic literature predominantly generated in the UK and the United States. Further research could involve taking this approach to defining and measuring HPF in a different cultural setting.

4.6 Conclusion

The association between a measure of HPF consumption derived from detailed food diaries and a more conventional measure of HPF consumption (self-reported frequency of meal preparation by the household MFP) was significant in the highest category of meal preparation frequency, with participants living in households where main meals were prepared at home every day deriving more of their energy intake from HPF (6.7%) than participants whose household MFP prepared a main meal at home twice a week or less. While this difference is small, it must be considered in the context of an overall low proportion of energy being derived from HPF, at 27.3% in this sample. This relatively low energetic contribution is discussed in greater length in the following chapter, where this measure is applied to the complete NDNS sample (2008-2016).

After adjustment, intermediate categories of frequency of at-home main meal preparation did not differ significantly in proportion of energy from HPF from the lowest frequency category, though this may be attributable to the low proportion of participants in these categories, with 71% of participants living in household where a main meal was prepared at home by the MFP every day.

The association between the two measures of HPF consumption did not vary significantly between different population sub-groups, suggesting that the food diary-based measure captures a similar proportion of home-prepared food across different groups.

5 HOME-PREPARED FOOD, DIETARY QUALITY AND SOCIO-DEMOGRAPHIC FACTORS: A CROSS-SECTIONAL ANALYSIS OF THE UK NDNS 2008-16

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5.1 Abstract

Background: Evidence suggests eating home-prepared food (HPF) is associated with increased dietary quality, while dietary quality varies across socio-demographic factors. Although it has been hypothesised that variation in HPF consumption between population sub-groups may contribute to variation in dietary quality, evidence is inconclusive. This study takes a novel approach to quantifying HPF consumption and describes HPF consumption in a population-representative sample, determining variation between socio-demographic groups. It tests the association between HPF consumption and dietary quality, determining whether socio-demographic characteristics moderate this association.

Methods: Cross-sectional analysis of UK survey data (N=6364, aged≥19; collected 2008-16, analysed 2018). High dietary quality was defined as 'DASH accordance': the quintile most accordant with the Dietary Approaches to Stopping Hypertension (DASH) diet. HPF consumption was estimated from 4-day food diaries. Linear regressions were used to determine the association between HPF consumption and socio-demographic variables (household income, education, occupation, age, gender, ethnicity and children in the household). Logistic regression was used to determine the association between HPF consumption and DASH accordance. Interaction terms were introduced, testing for moderation of the association between HPF consumption and DASH accordance by socio-demographic variables.

Results: HPF consumption was relatively low across the sample (mean(SD) % of energy consumption = 26.5%(12.1%)), and lower among white participants (25.9% v 37.8% and 34.4% for black and Asian participants respectively, p<0.01). It did not vary substantially by age, gender, education, income or occupation. Higher consumption of HPF was associated with greater odds of being in the most DASH accordant quintile (OR=1.2 per 10% increase in % energy from HPF, 95% CI 1.1-1.3). Ethnicity was the only significant

moderator of the association between HPF consumption and DASH accordance, but this should be interpreted with caution due to high proportion of white participants.

Conclusions: While an association exists between HPF consumption and higher dietary quality, consumption of HPF or HPF’s association with dietary quality does not vary substantially between socio-demographic groups. While HPF may be a part of the puzzle, it appears other factors drive socio-demographic variation in dietary quality.

5.2 Introduction

Policymakers and advocates have stressed the importance of home food preparation, and countries such as Brazil,[37] Japan[39] and Canada[199] have included cooking and food and cooking skills in their dietary guidelines. Further downstream, cooking and food classes and workshops constitute popular public health interventions.[88,200,201] However, systematic reviews conclude that evidence of significant and lasting change in either dietary behaviours or related health outcomes as a result of these interventions is limited.[88,200,201] Cooking skills interventions often target groups known to have, in general, a lower dietary quality, such as men[202] and less affluent individuals,[203] suggesting that worse dietary quality in these groups is suspected to be driven by different home food preparation behaviours. As discussed in Chapter 1, an implicit assumption that some groups either cook less, or that the meals they cook are somehow less healthy, seems to underpin this sort of intervention.

Cultural and behavioural differences pertaining to class, ethnicity, gender and generation could mean that the meals consumed by some groups are less healthy than others. Alternatively, home food preparation may be less important to the dietary quality of more affluent groups, as the higher purchasing power wielded by these individuals may allow them broader choice in prepared and out of home food options, including some which may be healthier. However, this remains something of an open question: while research suggests healthier diets are more expensive, studies have generally focused on the relative cost of ingredients as opposed to prepared foods.[189,204,205] Two studies of ready meals available in UK supermarkets found conflicting results, with one concluding that healthier ready meals were not more costly, and the other concluding that they were.[206,207]

As discussed in Chapters 1 and 4, definition and measurement issues surround home food preparation and home-prepared food (HPF), with most studies approaching measurement by asking how frequently participants either make or eat a home-prepared meal. This study deploys the food diary-based measure of home-prepared food consumption outlined in Chapter 4 to answer the questions:

1. What is the proportion of total energy derived from HPF in the UK population, and does this vary by socio-demographic characteristics?
2. Is proportion of total energy derived from HPF associated with diet quality?
3. Do socioeconomic position and demographic variables moderate the relationship between the energy derived from HPF and dietary quality?

5.3 Methods

This study represents a cross-sectional analysis of dietary surveillance data from the UK NDNS 2008-16 (May 2018 release).[192] It is reported according to the STROBE-nut recommendations.[208]

NDNS is an annual cross-sectional survey which collects information on food consumption and nutritional and health status of free-living individuals in the UK. Sampling, recruitment and data collection are carried out in a consistent manner, allowing data from different survey years to be combined for cross-sectional analysis. A detailed account of the NDNS recruitment and sampling protocol has been published elsewhere.[193,209,210] NDNS was approved by the Oxfordshire Research Ethics Committee and written informed consent was obtained from all participants. Individuals aged ≥19 years at the time of participation who completed three or four days of the food diary were included in the analyses.

5.3.1 Dietary assessment

Participants completed unweighed food diaries, including all food and beverages consumed both inside and outside the home. This process is described in detail elsewhere.[196] Participants also recorded where the food was eaten, for example at home, in a restaurant or café, or at work. This variable included a specific category for food eaten at work but brought from home.

5.3.2 Characterisation of food-related variables

5.3.2.1 Energy from home-prepared food

Proportion of energy from HPF was calculated from food diaries using the method described in Chapter 4 (4.3.3 Consumption of energy from home-prepared food). In this analysis, proportion of energy from HPF was modelled as a continuous variable.

5.3.2.2 Dietary quality

Dietary quality was determined by quantifying accordance to the Dietary Approaches to Stopping Hypertension (DASH) dietary pattern using a method adapted for use with NDNS[211] from an existing index.[212] The DASH diet has been shown to lower blood pressure[213] and reduce low-density lipoprotein cholesterol levels,[213] as well as being associated with a lower risk of stroke and coronary heart disease.[212] This score is based on food and nutrients emphasised or minimised in the DASH diet, and has eight components: high intake of fruits, vegetables, nuts and legumes, low-fat dairy products, and whole grains; and low intake of sodium, red and processed meats, and non-extrinsic milk sugars; all adjusted for total energy intake. The score is adjusted for overall energy intake. Components are evenly weighted, and three components (sodium, sugar, and red and processed meats) are reverse scored, so that higher consumption would lower an individual's DASH score. The overall score ranges between 8 and 40, with higher scores indicating a diet which has greater accordance with the DASH pattern.

This study models DASH accordance as a binary variable, with participants in the top quintile of DASH score being considered the most DASH-accordant, a method which has been previously employed by a number of studies.[211,214,215]

5.3.3 Socio-demographic variables

Age, sex, ethnicity, and the presence of children in participant households were determined using self-reported survey responses. Socioeconomic position was also assessed using self-reported survey responses, and was characterised using three markers: occupation (among employed participants; occupation was classified using the simplified three-class version of the National Statistics Socio-economic Classification described by the UK's Office for National Statistics[178]), highest educational attainment, and quintile of annual household income equivalised for household composition. Evidence suggests these socioeconomic markers present different associations with dietary intake, and are not necessarily interchangeable.[216]

5.3.4 Analysis

Variables were weighted using weights provided by the NDNS study team, which sought to mitigate bias resulting from the survey design and from differential non-response by individual participants.[198]

The mean proportion of energy from HPF consumed by participants was determined. Linear regression was used to determine how this proportion varied by socio-demographic characteristics, using socio-demographic characteristics as exposure variable and proportion of energy from HPF as an outcome variable.

Logistic regression was used to determine the association between proportion of energy from HPF and DASH accordance. Interaction terms were introduced to test for effect modification by socio-demographic characteristics. If any interaction terms were significant, models stratified by the socio-demographic variable in question were run to determine association between energy from HPF and DASH adherence in each population sub-group.

All regressions were mutually adjusted for all socio-demographic variables. All analyses were conducted using Stata (version 14; Stata Corp.). Alpha-level of 0.01 was used throughout to test for statistical significance in order to compensate for multiple testing.

5.4 Results

Overall, 54% (N = 12,070) of individuals selected to take part in NDNS provided useable food diaries (three or four complete days), including 6364 participants aged ≥19 years.[209,210,217]

The mean percentage of energy derived from HPF in the sample was relatively low (Mean (SD) = 26.5% (12.1%)). Table 9 describes the proportion of energy derived from HPF by population sub-group and presents the results of a linear regression with socio-demographic characteristics as the exposures and proportion of energy from HPF as the outcome.

Table 9 Description of energy from HPF by population sub-group, and associations between socio-demographic characteristics and proportion of energy from HPF

Characteristic	n (%)	Proportion of energy from HPF (%) Mean (SD) (%)	Regression[a] coefficient	95% CI	P>|t|
Total	6364 (100)	26.5 (12.1)			
Age group					
19-24 (ref.)	645 (10.1)	26.6 (13.0)			
25-49	2761 (43.4)	27.0 (12.5)	-0.2	-2.2-1.8	0.84
50-64	1547 (24.3)	26.2 (11.8)	-0.1	-2.3-2.0	0.93
65+	1411 (22.2)	25.8 (11.1)	0.3	-1.9-2.5	0.81
Sex					
Male (ref.)	2640 (41.5)	25.8 (12.1)			
Female	3724 (58.5)	27.1 (12.1)	1.5	0.6-2.4	**<0.01**
Ethnicity					
White (ref.)	5907 (92.9)	25.9 (11.6)			
Mixed ethnicity	58 (0.9)	28.0 (13.5)	-0.9	-5.7-3.9	0.70
Black or Black British	133 (2.1)	37.8 (15.8)	14.5	10.9-18.2	**<0.01**
Asian or Asian British	177(2.8)	34.4 (14.9)	7.6	4.8-10.3	**<0.01**
Other	82 (1.3)	34.6 (14.4)	10.8	6.4-15.1	**<0.01**
Children living at home					
None (ref.)	4392 (69.0)	26.0 (11.9)			
Children aged <16	1103 (17.3)	27.5 (12.2)	0.2	-1.1-1.8	0.71
Children aged <5	869 (13.7)	28.3 (12.7)	1.7	0.2-2.5	0.03
Educational attainment					
Degree level (ref.)	1461 (25.5)	27.8 (12.2)			
12-13 years of education	1505 (26.2)	26.4 (11.8)	-1.7	-2.9- -0.4	**<0.01**
11 years of education and/or vocational course	1315 (22.9)	25.9 (11.9)	-1.0	-2.4-0.4	0.18
<11 years of education	1457 (25.4)	25.6 (12.0)	-2.5	-4.1- -0.9	**<0.01**
Equivalised income quintile					
5 (Highest) (ref.)	1061 (19.5)	26.4 (11.9)			
4	1093 (20.1)	26.6 (11.4)	0.8	-0.5-2.2	0.21
3	1099 (20.2)	26.7 (12.6)	1.8	-0.3-3.2	0.02
2	1067 (19.6)	26.0 (12.5)	0.9	-0.6-2.4	0.25
1 (Lowest)	1132 (20.8)	26.8 (12.2)	1.2	-0.4-2.8	0.15
Occupation					
Professional and managerial (ref.)	2468 (40.7)	26.5 (11.6)			
Intermediate occupation	1911 (31.5)	26.7 (11.9)	0.8	-0.2-1.9	0.13
Routine and manual occupation	1684 (27.8)	28.6 (12.6)	0.2	-1.1-1.4	0.79

[a]Mutually adjusted for other socio-demographic variables

Proportion of energy from HPF did not vary substantially by socio-demographic variables. A small increase was associated with being female v male (27.1 v 25.8%, p<0.01), and a small decrease was associated with having 12-13 years of education or <11 years of education relative to having a university degree (26.4 p<0.01 and 25.6 p<0.01 v 27.8% respectively). More substantial variation was associated with ethnicity, with Black participants (37.8%), Asian participants (34.4%) and participants belonging to other ethnic groups (34.6%) consuming substantially more HPF than White participants (v 25.9%, all p<0.01).

Meanwhile, the expected associations between socio-demographic characteristics and dietary quality were found (methods and results reported in Appendix 3).

Table 10 shows the results of a logistic regression with proportion of energy from HPF as the exposure and DASH adherence as the outcome before and after adjustment for age, sex, ethnicity, presence of children in the household, income, education and occupation (full reporting of adjusted model in Appendix 3). In the unadjusted model, there is a small but statistically significant association between the variables, with an increase in 10% of energy from HPF resulting in a 20% increase in the odds of being DASH-adherent. This remained unchanged after adjustment. Given the low mean value of energy from HPF, a 10% increase would represent a substantial change, slightly lower than a change of one standard deviation (12.1%).

Table 10 Logistic regression of DASH adherence and proportion of energy from HPF (per 10%)

Model	OR	95% CI	P>|t|
Unadjusted model	1.19	1.13-1.27	**<0.01**
Adjusted model[a]	1.20	1.11-1.31	**<0.01**

[a]Mutually adjusted for other socio-demographic variables

The interaction term for Asian participants relative to White participants was significant (p<0.01), suggesting the association between proportion of energy from HPF and DASH adherence was different in this group. Although the interaction term for Asian ethnicity was statistically significant, stratified regression was not performed. Due to the small number of non-White participants in the NDNS sample (see Table 9), the interpretation of the interaction term was challenging, and running fully adjusted logistic regressions for each sub-group was impossible. While there may be a difference in the association between HPF consumption and DASH accordance in different ethnic groups, a more ethnically diverse sample would be required to properly examine it.

All other interaction terms were non-significant (p>0.01); further analyses were therefore not performed.

5.5 Discussion

5.5.1 Statement of principal findings

This study took a novel approach to quantifying HPF consumption, deriving estimates from 4-day food diaries. The proportion of energy from HPF was relatively low across the sample (Mean (SD) = 26.5% (12.1%)). Consumption of HPF did not vary substantially by any of the socio-demographic variables considered here, with the exception of ethnicity. Meanwhile, dietary quality varied extensively across socio-demographic variables, in ways similar to what has been seen in other studies, with women, older participants, more affluent participants and non-white participants displaying higher dietary quality than their counterparts.

An association between HPF consumption and dietary quality appeared across the sample: a 10% increase in energy derived from HPF was associated with a 20% increase in the odds of falling in the most DASH-accordant quintile. However, it must be acknowledged that a 10% increase is large given the low contribution of HPF to the energetic intake of most participants (close to one standard deviation, at 12%). Socio-demographic variables did not moderate the association between consumption of HPF and dietary quality, except potentially in the case of ethnicity.

Non-White participants consumed a greater proportion of energy from HPF and had a higher dietary quality. In addition, moderation analysis suggested that the association between consumption of HPF and dietary quality may differ across ethnicities. However, it is difficult to ascertain this: small numbers in other ethnic groups precluded stratified analysis. This could be investigated through further research.

5.5.2 Strengths and weaknesses of the study

Weighted, NDNS is UK population-representative, giving this study broader generalisability. However, a similar analysis conducted in different national contexts might yield different results, particularly in countries where 'traditional' food patterns remain stronger than they seem in the UK, such as in countries where a substantial proportion of the population adheres to the Mediterranean diet pattern. Comparative research of, for example, the UK and France suggests that, while there are certain convergent patterns that emerge in both countries, such as an increased use of convenience foods, and a reporting of a lack of time to cook, there are also ways in which home food practices remain distinct between countries, such as the absence of totally pre-

prepared ready meals among French participants, and an increased propensity to cook 'from scratch'.[218] Meanwhile, a comparative analysis of trends in time spent eating at home in five different countries found that time spent decreased in all countries except France.[12] It would be interesting to see how the association found here might differ in a range of contexts where food practices might diverge, as the implications for interventions and policy might be different in other contexts.

This study uses the DASH score, a well-evidenced and relatively comprehensive measure of dietary quality. The food-related variables in this study were derived from unweighed, self-reported food diaries. While evidence suggests that food diaries are a more accurate measure of dietary intake than other common measures such as food frequency questionnaires,[219] misreporting in self-measured dietary instruments is a well-documented limitation.[217,220]

In addition, there is potential for residual confounding due to characteristics that were not adjusted for in this analysis, such as food insecurity or characteristics of the food environment. Although there is evidence that both of these factors are associated with dietary quality, the evidence on how they are related to home food preparation is more limited. One study of home food preparation in low-income, food insecure women in Canada found that households that were more food insecure reported less complex home food preparation, though not less frequent preparation of meals 'from scratch',[221] although it is not clear whether this is suggestive of a protective effect of home food preparation against food insecurity, or a decrease in home food preparation in response to the stresses attendant on becoming food insecure, or some further factor. Regarding food environments, a study set in urban regions across five European countries (including the UK) found that greater access to restaurants was associated with reduced self-reported frequency of cooking.[52] Both these exposures are also likely to be socio-economically patterned and may associate with some of the socio-economic indicators examined here.

Further work could consider how they might affect the association between HPF consumption and dietary quality.

Finally, this analysis represents a cross-sectional analysis of the associating between HPF consumption and dietary quality. Further, longitudinal work could be done to verify how HPF consumption relates to diet-related health outcomes.

5.5.3 Interpretation and implications of the findings

The relatively low proportion of energy from HPF is reflective of my measure: many common breakfast choices (such as toast or cereal) and lunch choices (sandwiches) are not classified as home prepared. While my choices regarding classification could be debated, my measure has the advantage of internal consistency, with the definition of what is home-prepared being the same for all participants. In addition, my classification is informed by the literature, reflecting qualitative conceptualisations[195,222] and behavioural measures used in quantitative studies of home food preparation.[81]

Many studies of dietary quality and food preparation have focused on home food preparation frequency[54,58–60,65,223,224], and skills[58,225–228] as opposed to HPF consumption. Some studies of HPF consumption and dietary quality exist, but it is difficult to compare results due to the diversity of measures of dietary quality in use, with many focusing on intake of individual food groups as opposed to an overall index of diet quality. One study using a UK-based cohort examined the association between self-reported frequency of consuming home-prepared meals and several indices of dietary quality, including DASH score,[50] estimating that eating a home-prepared main meal more than five times a week, as opposed to less than three times a week, was associated with an 0.61 increase in DASH score. Due to the relative nature of the DASH index used here,[212] and the different approaches to modelling both DASH score and consumption of HPF, it is difficult to carry out an exact comparison, other than to say that both associations are statistically significant but moderate.

Quantitative studies of HPF consumption and socio-demographic variables are limited, although analyses of home preparation skill and frequency do exist.[13,74,168] Studies generally find that women cook more frequently than men,[13,74] which may also be the case in this dataset. Two studies from the United States found households with lower household income and educational attainment were more likely to cook always or never, compared to more affluent households who were more likely to sometimes cook at home.[54,73] These analyses also found that Black households reported cooking less frequently, whereas the reverse is suggested by my data. However, the different historical, cultural and national origins of Black populations in the US and the UK make distinct dietary patterns unsurprising. Black British populations are dominated by individuals of Caribbean and West African ancestry, communities themselves have distinct dietary patterns,[229] despite being grouped together within this study due to limited ethnic diversity in my study sample.

These results confirm an association between HPF consumption and dietary quality, although the association is relatively small. As interventions to increase home food preparation encounter issues of cost and scalability, as well as showing equivocal evidence of long-term impact in participants,[88,200,201] it is unclear that this justifies further policy action in terms of improving dietary quality. In addition, the small contribution of HPF to the energetic intake of most participants suggests that changing home food preparation practices might have more limited potential to impact overall dietary quality than might be assumed.

These results further suggest that differences in levels of consumption of HPF may not be key drivers of dietary inequalities along the socio-demographic axes examined here, and although this could be further explored, it does not appear that level of HPF consumption mediates the association between socio-demographic factors and dietary quality.

In addition, most socio-demographic variables do not appear to moderate the association between consumption of HPF and dietary quality, suggesting that different groups are eating HPF with similar nutritional properties, although other dietary components may be compensating in some systematic way, resulting in inequalities in diet quality and intake. To my knowledge, only one other study, conducted in the United States, has examined whether the association between HPF and diet quality are different between different socio-demographic groups.[67] This study compared frequency of "cooking dinner" in participant households with diet quality as measured by the Healthy Eating Index-2015 score, and found that, while higher frequency of cooking dinner was associated with higher diet quality for all participants, the effect size was greater among participants with high household income compared to low household income. While the authors also used a different approach to measuring home-prepared food consumption than was used in this study, the similarity of their measure to the frequency of at-home main meal preparation by household main food provider which was compared to my measure in Chapter 4 makes it less likely that differences in results were attributable to these differing measurement approaches. A likely explanation may be in the different national contexts of the work. At-home meal preparation was much less frequent in the American study, with only 36% of participants preparing dinner at home 7 days a week,[67] compared to 71% in the sub-sample of NDNS participants where this data is available (see Chapter 4). Income inequality, and its repercussions for diet, may also be different in these different national contexts. Finally, variations in results may also be partially attributable to the fact that this study proceeded to a stratified analysis without first performing a test for effect modification, as was done in my study and has been recommended as good practice.[230]

Overall, in this study it appears that neither the amount nor the nature of HPF consumed by different population sub-groups is contributing substantially to the inequalities in dietary quality known to exist across these groups (and demonstrated again in this data). One exception to this may be in the case of variation across ethnicities, although the nature of this sample makes this difficult to comment upon.

This study presents a comparison between a nutrition-based characterisation of diet, DASH accordance, and a behaviour-based one, consumption of HPF. Other behaviour-based characterisations of diet exist, such as food ‘cooked from scratch’ or ‘traditional recipes’. More might be developed through qualitative work delving into how individuals conceptualise the food they prepare and eat. In order to understand which behaviours are most important for dietary quality, it is worth continuing to think about diet not only in nutritional terms but in behavioural ones reflecting people’s daily practices and understanding how these practices impact dietary intake.

Although consumption of HPF shows a small association with dietary quality, it does not appear to drive dietary inequalities between population sub-groups. This suggests that the remaining components of the diet, food consumed outside the home, and food consumed at home that is not home-prepared, may be driving dietary inequalities, which could be examined through further research. Some interventions have already sought to target these food sources, including supermarket interventions aiming to promote purchases of healthier snacks,[231] and restaurant menu labelling providing information on the nutrition and energetic content of various dishes.[232]

5.6 Conclusion

This study suggests relatively low levels of consumption of HPF across the population-representative sample and confirms a statistically significant but moderate association between consuming HPF and dietary quality. In addition, neither the amount nor the type of HPF consumed appeared to contribute substantially to inequalities in dietary quality across population sub-groups. These results suggest that the potential of changing HPF consumption as a means of improving dietary quality overall, and particularly for addressing diet-driven health inequalities, may be relatively limited. Further research may help to determine which other dietary components make a more substantial contribution to dietary quality and dietary inequalities.

6 Is home-prepared food a necessary condition for high dietary quality? A cross-sectional analysis of the UK NDNS 2008-2016

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6.1 Abstract

Background: Despite inconclusive evidence, the idea that a lack of home food preparation and skills is a limiting factor in achieving a healthy diet is widespread. Cooking skills interventions proliferate, and several countries now mention cooking in their dietary guidelines. The aim of this study was to determine whether substantial consumption of home-prepared food is necessary for high dietary quality by exploring whether individuals can eat healthily while eating little home-prepared food. The diets of these individuals were characterised, and socio-demographic characteristics and prevalence of obesity were also explored.

Methods: Cross-sectional analysis of UK dietary survey data with objectively measured height and weight and a 4-day food diary for each participant was conducted. A subsample (N=1,063, aged ≥19 years) with a high dietary quality (determined using a score derived from the Dietary Approaches to Stopping Hypertension (DASH) diet) was analysed. Within this, participants were grouped as either high or low home preparation based on the proportion of energy derived from home-prepared food. Regression models were used to determine whether and how those in the high and low home preparation groups differed in terms of socio-demographic characteristics, DASH score, energy intake, prevalence of obesity, and dietary composition.

Results: The low home preparation group included 442 participants, while 621 participants were in the high home preparation group. The low home preparation group were more likely to be older and white, and less likely to have a degree level education. After adjustment for socio-demographic characteristics, there were no differences in DASH score, energy intake or obesity prevalence between the groups. After adjustment, the low home preparation group consumed more fruit (30.8 additional g/day, 95% CI 5.5-56.1), more low-fat dairy foods (24.6 additional g/day, 95% CI 1.7-47.5) and less red

meat (10.4 fewer g/day, 95% CI 4.3-16.6), but also more sugar (11.6 additional g/day, 95% CI 7.5-15.6) and sodium (107.8 additional mg/day, 95% CI 13.8-201.8).

Conclusion: Home food preparation should not be presented as a prerequisite to a high-quality diet. The public health community should recognise the existence of a set of food practices which allows individuals to achieve a healthy diet with little contribution from home-prepared food and make space for it in the design of their policies and interventions.

6.2 Introduction

Given the relatively small energetic contribution of HPF to overall dietary intake in the UK population (see Chapter 5), as well as evidence that time allocated to domestic foodwork (within which category falls home food preparation, as previously discussed) has continued to decreased in the UK (see Chapter 2), the importance of foods that are not home-prepared in the diets of UK adults is difficult to ignore. While cooking and food classes and workshops are a popular public health intervention, evidence of the effectiveness of these interventions is equivocal: systematic reviews conclude that evidence of significant and lasting change in either dietary behaviours or related health outcomes is limited.[88,200,201] Authors suggest this may in part be due to limitations in the design of both the interventions and their evaluations, but nevertheless existing evidence suggests that getting people to cook more or differently is difficult. With this in mind, it seems reasonable to pose the question: is substantial consumption of home-prepared food necessary for a healthy diet?

Promoting home cooking as a dietary public health intervention is based on the hypothesis that people who cook more have healthier diets and better health outcomes, an idea supported by some,[49,50,54–57] though admittedly not all,[66,68,233,234] of the evidence. However, preparing and eating food at home is complex, and the nutritional content of home-prepared meals can be highly variable, as can the nutritional content of meals prepared outside the home. One study showed that popular ready meals came closer to meeting dietary guidelines than homemade equivalents made using recipes from television chefs (though neither met the guidelines under study).[68] Another study reported no significant difference between the healthfulness of ready meals and meals made at home using recipes from popular online sources and cookery books.[69] In a longitudinal, multi-ethnic study of midlife women, women who spent more time on meal preparation were more likely to develop metabolic syndrome, leading the authors to conclude that public health interventions should emphasise healthfulness of cooking as opposed to just cooking frequency.[66]

Though evidence suggests that eating more home-prepared food is associated with better dietary quality,[50] the association between eating home-prepared food and dietary quality may be heterogeneous depending on what exactly is eaten.

An earlier (recently replaced) version of France's *Guides alimentaires du programme national nutrition-santé* (national dietary guidelines)[235] proposed recommendations for different types of eaters, including for individuals who 'do not cook'. Suggestions included bread and cereals, salad, fruit, milk and cheese. This seems to reflect a belief that it is possible to achieve a high-quality diet while eating food that requires little or no home preparation. To the best of my knowledge, this hypothesis has not been quantitatively examined.

The aims of this study were (1) to determine whether substantial consumption of home-prepared food is for high dietary quality by exploring whether individuals can achieve a relatively high quality of diet while obtaining a relatively low proportion of their energy from home-prepared food; and (2) to characterise the diets of these individuals, if found, relative to their counterparts who also achieved a high quality diet while consuming a relatively large proportion of energy from home-prepared food. Individual-level socioeconomic and demographic characteristics of the two groups were also compared, as well as prevalence of overweight or obesity.

6.3 Methods

This study represents a cross-sectional analysis of dietary surveillance data from the UK NDNS 2008-16 (May 2018 release).[192] It is reported according to the STROBE-nut recommendations.[208]

6.3.1 Data source

NDNS is an annual cross-sectional survey which collects information on food consumption and nutritional and health status of free-living individuals in the UK. Sampling, recruitment and data collection are carried out in a consistent manner, allowing data from different survey years to be combined for cross-sectional analysis.

A detailed account of the NDNS recruitment and sampling protocol has been published elsewhere.[193,209,210] In short, private addresses were randomly selected from postcode sectors across the UK. Within each household, a maximum of one adult and one child were randomly selected for inclusion in the study. These individuals were asked to complete a four-day food and drink diary, and to participate in an interview concerning more general dietary habits, socio-demographic status, lifestyle and physical activity, and receive a nurse visit which included measurement of height and weight.

NDNS was approved by the Oxfordshire Research Ethics Committee and written informed consent was obtained from all participants.

6.3.2 Inclusion criteria

Individuals aged ≥19 years at the time of participation, who completed three or four days of the food diary, were included in the analyses. In order to compare those who achieved a relatively high dietary quality with and without a relatively high proportion of energy from home-cooked foods, only a sub-sample of the NDNS sample (the analytic sample) was included in this analysis: those in the top tertiles of both proportion of energy from home-prepared food and dietary quality (hereafter the high home preparation group), and those in the top tertile of dietary quality and the bottom tertile of energy from home-prepared food (the low home preparation group). This resulted in an analytic sample with universally high dietary quality, allowing inter-group differences to be associated with consumption of home-prepared food as opposed to dietary quality.

6.3.3 Dietary assessment

Participants completed unweighed food diaries, including all food and beverages consumed both inside and outside the home for three or four consecutive days. This process is described in detail elsewhere. [196] Participants also recorded where the food was eaten, for example at home, in a restaurant or café, or at work. This variable included a specific category for food eaten at work but brought from home.

6.3.4 Characterisation of food-related variables

Food-related variables – proportion of home-prepared food and dietary quality, as well as other aspects of diet such as daily intake of food groups, energy and macro- and micronutrients – were derived from food diaries. The first two variables were derived in order to classify participants as being either in the high or low home preparation group. Further food-related variables were derived in order to characterise dietary intake in greater detail.

6.3.4.1 Energy from home-prepared food

Proportion of energy from home-prepared food for each participant was determined using the method described in Chapter 4 (4.3.3 Consumption of energy from home-prepared food). Participants were then separated into tertiles based on this proportion. Individuals in the highest tertile for proportion of energy from home-prepared foods were categorised as belonging to the high home preparation group, while those in the lowest tertile were categorised as belonging to the low home preparation group.

6.3.4.2 Dietary quality

Dietary quality was determined by quantifying accordance to the Dietary Approaches to Stopping Hypertension (DASH) dietary pattern using a method adapted for use with NDNS[211] from an existing index.[212] The DASH diet has been shown to lower blood pressure[213] and reduce low-density lipoprotein cholesterol levels,[213] as well as being associated with a lower risk of stroke and coronary heart disease.[212] This score is based on food and nutrients emphasised or minimised in the DASH diet, and has eight components: high intake of fruits, vegetables, nuts and legumes, low-fat dairy products, and whole grains; and low intake of sodium, red and processed meats, and non-extrinsic milk sugars; all adjusted for total energy intake. The score is adjusted for overall energy intake. Components are evenly weighted, and three components (sodium, sugar, and red and processed meats) are reverse scored, so that higher consumption would lower an individual's DASH score.

Participants were separated into tertiles by DASH score. Participants in the highest tertile were categorised as high-DASH.

6.3.4.3 Intake of energy, macronutrients and micronutrients

Mean daily intake of energy was estimated by the NDNS team using food diaries, as were daily intakes of several macro- and micronutrients: fat, saturated fat, protein, carbohydrate, sugar, and sodium, a process described in detail elsewhere.[196] These nutrients make up mandatory nutrition labelling in the UK.[236] Intake was categorised as meeting or not meeting relevant UK dietary guidelines,[237,238] except in the case of carbohydrates. Current UK recommendations suggest a population mean of approximately 50% of total energy from carbohydrate, but note that total carbohydrate intake does not appear to be associated with health outcomes, as it is composed of different nutrients such as fibre, sugar and starches, which may have a variety of impacts.[239] Therefore, carbohydrate intake was described in all groups, but adherence to a particular recommendation was not defined.

Daily intakes of other nutrients were also estimated by the NDNS team using food diaries.[196] Where UK guidelines existed,[237] accordance to these guidelines was also determined. Nutrients included were: fibre, thiamine, riboflavin, niacin, vitamin B6, vitamin B12, folate, vitamin C, vitamin A, calcium, phosphorus, magnesium, zinc, selenium, iodine, iron, chloride, vitamin E, copper, manganese, biotin, and pantothenic acid. Nutrients derived from supplements were not included in the data presented here.

6.3.4.4 Intake of food groups

Daily intakes of the main food groups determined by NDNS were calculated using food diaries. Where possible similar groups of food were collapsed (e.g. 1% fat milk, skimmed milk and semi-skimmed milk).

6.3.5 Prevalence of overweight and obesity

Interviewers collected measurements of height and weight from NDNS participants using standard protocol. These measures were used to calculate BMI, which was categorised as overweight/obese (BMI $\geq 25kg/m^2$), or not.

6.3.6 Socio-demographic variables

Socio-demographic variables considered include age, sex and ethnicity (categorised as white or not due to the high proportion of white participants in NDNS) were determined using self-reported survey responses, as were the presence of a child under 16 years of age in participant households. Socioeconomic position was also assessed using self-reported survey responses and was characterised using a range of markers: occupation (professional/other), education (degree level or above/other), and annual income equivalised for household composition (above or below £35,000).

6.3.7 Analysis

The demographic and socioeconomic characteristics of individuals in the high-home preparation and low home-preparation groups were described. The statistical significance of differences between groups was tested using either a linear or logistic regression as appropriate, mutually adjusted for all other socio-demographic variables.

Overall dietary characteristics were examined in two ways. First, the high home preparation and low home preparation groups were compared in terms of DASH score, proportion of energy from home-prepared food, energy intake, and adherence to dietary guidelines for macro- and micronutrients. Prevalence of overweight or obesity was also compared across groups. Second, the groups were compared in terms of their intake of each of the food groups or nutrients that make up each of the eight components of the DASH diet and index: low-fat dairy, whole grain, fruit, vegetables, nuts and legumes, sodium, sugars, and red and processed meats. In both cases, the statistical significance of differences between groups was tested using either a linear or logistic regression as appropriate, adjusted for all socio-demographic variables.

In addition, food-level differences between home preparation groups were then assessed through an examination of the food group codes provided by NDNS. Due to the high proportion of individuals who did not consume many of the food groups over the course of the recorded days, this was done in two steps. First, the proportion of individuals consuming any amount from each food groups was calculated for both the high home preparation and the low home preparation groups. Differences in these proportions were tested using logistic regression. Second, the median quantity of each food group consumed by consumers of those food groups was determined. Differences between home preparation groups in these quantities were tested using linear regression. All regressions in food-level analyses were adjusted for all socio-demographic variables.

All analyses were conducted using Stata (version 14; Stata Corp.). Alpha-level of 0.05 was used throughout.

6.4 Results

Overall, 54% (N= 12,070) of individuals selected to take part in NDNS provided useable food diaries (three or four complete days), including 6,364 adults.[209,210,217] Adult participants classified by tertile of DASH score and proportion of energy derived from home-prepared food are displayed in Table 11.

Table 11 Adult NDNS participants by tertile of DASH score and proportion of energy derived from home-prepared food n(% of adult study sample)

DASH score	Proportion of energy from home-prepared food			
	Low	Medium	High	Total
Low	1095 (17.2)	836 (13.1)	679 (10.7)	2610 (41.0)
Medium	703 (11.1)	697 (11.0)	713 (11.2)	2113 (33.2)
High	442 (7.0)	578 (9.1)	621 (9.8)	1641 (25.8)
Total	2240 (35.2)	2111 (33.2)	2013 (31.6)	6364 (100.0)

The analytic sample used in this study therefore included 1063 participants (16.7% of adult NDNS sample): 621 (9.8%) participants in the high home preparation group, and 442 (7.0%) participants in the low home preparation group. While NDNS is a nationally representative sample, the analytic sample differs from the rest of the NDNS sample, notably in having a higher socioeconomic position, as well as being older, less likely to be male or white, and less likely to have a child aged under 16 living at home (Appendix 4).

Table 12 presents sample demographic and socioeconomic characteristics for individuals in the high and low home preparation groups. Table 12 shows that, after adjustment for all other sociodemographic variables, individuals in the low home preparation group were more likely to be older and white, and less likely to have a degree level education relative to the high home preparation group.

Table 12 Demographic and socioeconomic characteristics for high and low home preparation groups

Characteristic	High DASH			
	High home preparation	Low home preparation	Total	OR/regression coefficient (95 %CI)[1, 2]
n	621	442	1063	
Demographic				
Age (mean (95% CI))	51.0 (49.3, 52.6)	54.6 (52.7, 56.5)	52.4 (51.2, 53.7)	**3.02 (0.47, 5.57)**[3]
Sex (% male)	39.8	45.7	42.2	0.81 (0.58, 1.10)
Ethnicity (% white)	76.7	90.4	82.8	**0.42 (0.25, 0.73)**
Children (% with a child aged <16)	31.2	23.9	28.3	0.96 (0.62, 1.48)
Socioeconomic				
Education (% degree)	41.9	34.0	38.7	**0.69 (0.48, 0.99)**
Equivalised income (% >£35,000)	33.5	39.7	36.0	1.31 (0.90, 1.93)
Occupation (% professional)	50.9	55.7	52.8	1.17 (0.82, 1.68)

[1]Mutually adjusted for socio-demographic variables excluding the dependent variable: age, sex, ethnicity, children, education, income and occupation

[2]Odds ratios (95%CI), except for in the case of age

[3]This number represents a regression coefficient (95% CI), as age was analysed as a continuous variable.

Table 13 presents an overview of dietary characteristics of those in the high and low home preparation groups. Table 13 shows that, after adjustment for socio-demographic characteristics, both groups achieved the same levels of DASH adherence, and showed no significant differences in their mean daily energy intake (kcal) or their prevalence of overweight and obesity, despite proportion of energy they derive from home-prepared food being substantially and significantly different. At a nutrient level, however, some differences emerged. In the low home preparation group, a smaller proportion of participants adhered to dietary guidelines for sugar and sodium; but there were no between-group differences in proportion adhering to guidelines on fat, saturated fat and protein.

Information about adherence to micronutrient guidelines can be found in Appendix 4. The low home preparation group had a higher prevalence of individuals meeting guidelines for riboflavin, folate and calcium, while the high home preparation group saw more participants meeting guidelines for vitamin A, zinc and selenium. There were no significant differences in adherence to fibre guidelines.

Table 13 Dietary characteristics and prevalence of overweight or obesity for high and low home preparation groups

Characteristic	High DASH			
	High home preparation	Low home preparation	Total	Regression coefficient (95 %CI)[1]
DASH score (Median (IQR))				
	30 (29,32)	30 (29,32)	30 (29,32)	-0.32 (-0.71, 0.07)
% of total energy from home-prepared food (Mean (95% CI))				
	41.8 (40.8, 42.7)	15.4 (14.8, 15.9)	31.2 (29.9, 32.5)	**-0.26 (-0.27, -0.25)**
Mean daily energy intake kcal (Mean (95% CI))				
	1772 (1720, 1825)	1861 (1804, 1918)	1808 (1769, 1847)	45.6 (-25.8, 117.1)
Prevalence of obesity/overweight (% obese or overweight (≥25 kg/m^2))				
	52.6	55.8	53.9	1.07 (0.78, 1.46)
Mean daily nutrient intake: % meeting guidelines	High home preparation	Low home preparation	Total	OR (95 %CI)[1]
Fat (<35% energy)	58.8	60.0	59.3	1.07 (0.77, 1.49)
Saturated fat (<11% energy)	45.1	38.1	42.3	0.85 (0.61, 1.18)
Protein (45-56 g)[2]	92.4	90.8	91.8	0.53 (0.28, 1.01)
Sugar (<11% energy)	79.1	59.0	71.1	**0.39 (0.27, 0.55)**
Sodium (<1600 mg)	36.0	26.3	32.1	**0.71 (0.51, 1.00)**
Carbohydrate	49.3 (48.4, 50.2)	48.5 (47.9, 49.1)	48.0 (47.3, 48.7)	N/A

[1]Mutually adjusted for age, sex, ethnicity, children, education, income and occupation

[2]Dependent on body mass

Table 14 presents the daily quantity consumed of each of the eight food groups and nutrients that make up the DASH index.

Differences in quantities suggest that the high and low home preparation groups are achieving this measure of high dietary quality through different foods and nutrients. The low home preparation group consumed more fruit and low-fat dairy products, but also more sugar and sodium. The high home preparation group consumed more vegetables than their low home preparation counterparts, but also more red and processed meat.

More granular, food-level analysis of participant diets can be found in Appendix 4. These results mirror those displayed in Table 14: the low home preparation group consumed more low-fat dairy foods such as yoghurt and milk, while the high home preparation group consumed more vegetables. The low home preparation group consumed more whole grain foods requiring limited preparation, such as wholemeal bread and high fibre breakfast cereals. They also consumed a larger number of sweet things, such as sugar-sweetened beverages, biscuits and chocolates, as well as more crisps and salty snacks, mirrored by the higher levels of sugar and sodium in their diets. The high home preparation group ate more beef and lamb, contributing to a higher overall consumption of red and processed meat. Some results from the food-level analysis were not captured in Table 14, because the DASH index does not take them into account. For example, the high home preparation group also ate more eggs, chicken and fish, while the low home preparation group drank more wine and beer.

Table 14 Daily quantity of each DASH component consumed for high and low home preparation groups (Median (IQR))

DASH Component (median (IQR))	High DASH			
	High home preparation	Low home preparation	Total	Regression coefficient (95 %CI)[1]
Low-fat dairy (g)	186.9 (102.8, 283.0)	237.5 (143.8, 325.6)	207.5 (120.0, 305.0)	**24.6 (1.7, 47.5)**
Whole grain (g)	73.8 (46.0, 125.0)	86.0 (53.9, 128.0)	78.8 (48.8, 125.8)	2.2 (-6.8, 11.2)
Fruit (g)	193.8 (129.0, 297.1)	218.6 (138.8, 342.5)	201.8 (131.9, 312.6)	**30.81 (5.51, 56.1)**
Vegetables (g)	220.0 (167.2, 295.5)	175.7 (123.8, 225.4)	195.6 (143.7, 264.6)	-52.6 (-66.7, 38.6)
Nuts & legumes (g)	24.1 (0.8, 52.5)	26.4 (3.0, 52.5)	24.6 (0.9, 52.5)	-0.4 (-7.7, 7.0)
Sodium (mg)	1855.4 (1469.8, 2361.0)	1963.5 (1571.4, 2436.2)	1908.5 (1518.1, 2388.2)	**107.8 (13.8, 201.8)**
Sugars (g)	34.0 (20.7, 51.8)	44.3 (27.9, 65.4)	39.5 (23.1, 57.3)	**11.6 (7.5, 15.6)**
Red & processed meats (g)	39.0 (10.0, 73.8)	28.3 (1.5, 53.6)	33.0 (5.5, 65.0)	**-10.4 (-16.6, -4.3)**

[1]Mutually adjusted for age, sex, ethnicity, children, education, income and occupation

6.5 Discussion

6.5.1 Principal findings

This is the first analysis I are aware of to use dietary survey data to explore whether substantial consumption of home-prepared food is necessary in order to achieve a high-quality diet. I found that it is not: 7% of adult NDNS participants were in the top tertile for dietary quality as indicated by DASH score, while being in the bottom tertile of proportion of energy derived from home-prepared foods. While all study participants were in the highest tertile of DASH score, there was also no significant difference between the median DASH scores of the high and low home preparation groups, in their energy intakes, nor in the prevalence of overweight or obesity between groups.

Relative to their counterparts with a similar dietary quality who relied more heavily on home-prepared food, individuals in the low home preparation group are likely to be older, more likely to be white and less likely to have a degree level education. There are no significant differences in income or occupational grade between the two groups, although both groups were significantly more affluent in terms of education, income and occupation than the NDNS sample as a whole.

6.5.2 Strengths and weaknesses

From a socio-demographic perspective, the analytic sample used in this study was significantly different to the nationally representative NDNS sample (see Appendix 4). This was due to the research question, which demanded that only individuals in the top tertile of dietary quality be included. As previous studies have shown, individuals with high dietary quality tend to have certain socio-demographic traits, such as being older and more affluent,[240,241] a pattern which is reflected here.

The positive impact of the DASH diet on hypertension as well as on other chronic diseases has been repeatedly demonstrated, [212,212,213] and the DASH index used in this study is in line with that used in epidemiological studies that have reported these associations.[212] As a marker of dietary quality, it is very well-evidenced. However, these studies relate the positive health associations of DASH to 'DASH adherence', defined as the top quintile of a population's DASH score. In this study, a wider definition was used in order to increase sample size, and participants in the top tertile of DASH were defined as having a relatively high dietary quality.

In addition, DASH does not take into account all of the foods that individuals may eat. The fact that some food-level differences are not captured by an examination of DASH score components highlights this. For example, the high home preparation group ate more fish and eggs, while the low home preparation group consumed more wine and beer.

Finally, diet-related disease may be caused by an excess consumption of energy, regardless of dietary quality. However, the DASH score does make food group consumption relative to the overall energetic content of the diet. In addition, the two groups under study did not differ in terms of energy intake.

Food-related measures were derived from food diaries, which were unweighed and self-reported. Some evidence suggests that food diaries are a more accurate measure of dietary intake than other common measures such as food frequency questionnaires.[219] However, misreporting in self-measured dietary instruments is a well-documented limitation,[220] and biomarker analysis of a sub-group of NDNS suggests participants underreport the energy they consume.[217] which may explain the surprisingly low average calorie intake in participants included in this study (Table 13). While this introduces error, it is not clear whether the two groups under study might misreport in systematically different ways.

This study took a novel approach to quantifying the proportion of home-cooked food in participants' diets. Previous studies and surveys have approached this by asking participants how often they cook, or how often they eat home-prepared or home-cooked foods.[242] These methods are subject to some limitations. The social desirability of cooking and home-cooked food[243] may introduce bias into participant responses to these sorts of questions. In addition, qualitative studies[45] suggest that there is some disagreement among study participants as to what constitutes home-cooked or –prepared food, meaning that the same response may mean different things to different people. While the classification of foods as home-prepared or not used in the current study may be somewhat arbitrary, and is certainly debatable, it has the advantage of being independent of participant interpretations of questions concerning cooking frequency or frequency of preparing meals from scratch.

6.5.3 Implications of the findings

Previous research has concluded that more frequent consumption of home-prepared food is associated with a higher dietary quality.[242] While this is also the case in the NDNS sample (see Chapter 5), the public health community currently lacks an effective method for changing home food preparation practices, as discussed in the introduction. While not discounting the existing work on this subject, it is difficult to see how to move forward with these findings. This study has instead explored individuals who do the unexpected, by eating healthily with minimal energetic contribution from home-prepared foods.

The finding that substantial consumption of home-prepared food is not necessary to achieve high dietary quality suggests that cooking skills interventions and dietary guidelines which emphasise home food preparation as being necessary to a healthy diet may be inappropriate. While home food preparation may be a useful practice for some to achieve greater dietary quality, it does not appear to be a necessary one. Recognising that people can have high quality diets with or without cooking and supporting them to eat healthily regardless seems important.

Examining the dietary composition of the low home preparation group might shed some light on how to support a healthy diet in people who do not eat much home-prepared food. The results of this study suggest that it is their high intake of sugar and sodium which must be addressed. The food-level analysis suggests that this intake may be driven by a higher consumption of prepared foods, such as biscuits, chocolate and candy, soft drinks, and crisps and other snacks. Sugar and salt reduction programmes are already under way in the UK,[244,245] as well as globally.[246,247] This higher intake of sugar and sodium could be addressed through further reformulation of these prepared foods. In addition, ways of increasing the availability of vegetables requiring little home preparation might be explored, such as increasing the servings of vegetables in prepared meals.

Although their diets are less healthy on some dimensions, most notably in the higher sugar and sodium content of their diet, participants in the low home preparation group are still achieving the same overall dietary quality as indicated by DASH score. This reflects that the DASH score is made up of several evenly weighted components, meaning that a given DASH score could reflect different combinations of healthy and less healthy foods.

Similar scores overall may also reflect the fact that DASH is a relative measure, and that the DASH scores of the participants discussed here were derived from an analysis of the complete adult NDNS sample, which included participants with a lower DASH score whose diets were not analysed in this study (Appendix 4). Although the low home preparation group were eating more of some ‘unhealthy’ foods than the high home preparation groups, their quantities were relatively similar in comparison to the quantities of the wider (lower-DASH) sample. This highlights the fact that a diet that is ‘healthy’ relative to population levels can still include some ‘unhealthy’ things.

The affluent nature of the analytic sample, which reflects a socioeconomic gradient in diet quality reported by many studies,[240,241] may limit some of the implications that can be drawn from this study. For example, it was noted that there are no significant differences in income between the low home preparation and the high home preparation groups. This might suggest that there is no additional cost involved in eating healthily without much home-prepared food. However, when I note that the analytic sample had a significantly higher prevalence of high-income individuals than the NDNS sample as a whole, it seems plausible that for individuals in the analytic sample cost is not a significant barrier, and dietary practices are driven more by other factors such as time or taste. While it may be possible to eat healthily without eating much home-prepared food, doing so may be more expensive, as, indeed, is eating healthily more broadly.[189]

6.5.4 Unanswered questions and future research

I require a better understanding of the conditions necessary to achieve a high-quality diet while eating low amounts of home-prepared food. The relatively high socioeconomic position of the analytic sample may mean that this group has more financial resources, or access to a specific array of food outlets due to neighbourhood food environment. Other conditions may also be necessary, such as food and nutrition knowledge, motivation, kitchen facilities, or access to a car. Further research may allow us to understand how practicable the high DASH low home preparation pattern is for the wider population, and what interventions might be carried out to make it practicable for larger numbers.

While cooking skills and practices have been discussed extensively,[45,222,248] eating healthily without relying on home-prepared food may also rely on its own non-cooking set of skills and practices. These could also be an interesting matter for research, although they may be as resistant to change through education interventions as cooking practices appear to be.

The use of food diaries to characterise dietary intake using related concepts such as food 'prepared from scratch' could be further investigated. The way these concepts relate to indices of dietary quality, nutritional intake, socio-demographic characteristics and health outcomes could be analysed.

Finally, a mirror analysis might be carried out which investigates home-prepared food consumption in a sample with low dietary quality.

6.6 Conclusion

This study suggests that consuming a substantial amount of home-prepared food is not necessary to achieve high dietary quality: a set of food practices are present in a sizable proportion of the population which allow individuals to achieve a high dietary quality while relying minimally on home-prepared foods. However, participants included in this study were significantly more affluent than the nationally representative sample from which they were drawn, suggesting that the practices in which these individuals engage may be dependent on socioeconomic position. This bears further inquiry.

The low home preparation group consumed more fruit and low-fat dairy products, and less red meat than the high home preparation group, but also more sugar and sodium, highlighting a need for further reduction of sugar and sodium in prepared foods.

The public health community should recognise the existence of a set of food practices which allows individuals to achieve a healthy diet with little contribution from home-prepared food and make space for it in the design of their policies and interventions.

7 Discussion

7.1 Overview

The results of the individual chapters included in this thesis have already been presented, evaluated and interpreted. This chapter seeks to draw these findings together with reference to the overarching aims of this thesis. Then, the strengths and weaknesses of the thesis as a whole will be discussed. Finally, the implications of the findings presented here will be discussed with regard to the necessity, feasibility and fairness of advocating and intervening to increase the prevalence of home food preparation.

7.2 Summary of findings

This thesis aimed to present a social epidemiology of foodwork and home-prepared food consumption, using nationally representative data from UK adults to:

3) Investigate how a 'lack' of time, in the form of competing demands on and other uses for time, is associated with time allocated to foodwork; and
4) Explore the association between home-prepared food consumption and diet quality.

The findings are summarised here with respect to these aims.

7.2.1 Uses of time and their association with foodwork

My analysis of foodwork from the perspective of time use was prompted by the frequency with which a lack of time is cited as a barrier to doing foodwork.[80,82,83,141–144] The compositional data analysis approach I employed in these analyses explicitly takes into account that everyone has the same 24 hours in a day. As a result, a lack of time can be conceptualised in these analyses as time which is otherwise allocated, although as noted in the relevant chapters the time use diary data informs us about substantive uses of time, which may be only one dimension of how people experience time, including how they experience rushedness.

Most narrowly, a lack of time may be understood as the non-discretionary demands placed upon the available time. These demands on time were operationalised in my analyses as time allocated to 'work', both paid and unpaid. That time allocated to work is a key driver of people's perception that they are short on time is supported by an existing piece of research using time diaries.[145] The authors of this study developed several measures (using time diary data) that they thought likely, based on existing literature and theory, to predict self-reported feelings of rushedness, including multi-tasking, activity fragmentation (measured by the frequency with which participants switched between different activities), and use of information and communications technology. However, they found that none of these measures predicted feelings of rushedness as well as time allocated to paid and unpaid labour.[145]

However, a lack of time may also represent time otherwise allocated to activities which are not tasks or duties. Some of these may meet physiological needs, such as sleep or eating, while others may be more important for enjoyment or wellbeing. This made it worth looking at variation in other uses of time.

My study of foodwork in the UK between 1983 and 2014, presented in Chapter 2, found that the decline in foodwork that had been observed in the latter part of the 20th century has continued into the 21st, with participation in foodwork, and, among participants who did foodwork, daily foodwork episodes and time allocated to foodwork, all decreasing. However, given that these changes in foodwork were not matched by a concurrent increase in time allocated to work (among either participants who engaged in foodwork or participants who did not), my findings do not support the idea that foodwork has been 'driven out' over time by an increase in time allocated to work. The compositional data analysis approach provided insight into which activities participants *were* spending more time on, with time allocated to sleep and leisure screen time increasing significantly and substantially.

This does not necessarily mean that other demands on time play no role in shaping time allocated to foodwork: the fact that economically inactive participants, who spend less time working and therefore have more discretionary time, allocate more time to foodwork than their economically active counterparts suggest that other demands on time do play a role. Further, it is plausible that the increase in time allocated to work between 1983 and 2000 contributed to the decrease in time allocated to foodwork, although it must be noted that the decrease in time allocated to foodwork was visible even among the economically inactive, where there was no concurrent increase in time spent working, and that participation in foodwork decreased significantly between 2000 and 2014, when there was no increase in time spent on work among both participants who engaged in foodwork and participants who did not. Our findings suggest that other mechanisms are also at work here, which may include a transition to less time-intensive approaches to home food preparation (perhaps enabled by a change in the types of dishes adults in the UK prepare, as well as changes in technology and available ingredients), but also the increasing normalisation of the consumption of foods that are not home-prepared, and the desire for more time to spend on rest and leisure.

In hypothesising about the mechanisms underpinning changes in time use it must be acknowledged that people often do not act as 'rational agents', 'choosing' how to allocate their time. Foodwork, as well as other activities, are habitual and situated, often undertaken with minimal recourse to strategic reasoning.[249,250] It is worth noting, therefore, that spending more time on, for example, screens, at the expense of foodwork, may not necessarily represent a decision that one activity has more importance than the other, though it may represent a change in social norms.

While Chapter 2 enabled me to look at time use over several decades, and determine, as time in foodwork decreased, whether time allocated to other activities increased, in Chapter 3 I focused on the most recent UK time use survey (2014), looking at time use across the whole sample in order to analytically compare how activities varied between participants who did no, some and more foodwork. In contrast to the analysis in Chapter 2, where I found that, as the years progressed and the time allocated to foodwork decreased, leisure screen time increased, in Chapter 3 I concluded that participants who did more foodwork did not 'fit it in' by spending less time on screens. Instead, participants who did more foodwork spent substantially less time on sleep than participants who only did some or no foodwork.

Finally, my analysis of foodwork and time use consistently confirmed the gendered nature of this practice. In Chapter 3, I found that women were over-represented in the group that did more foodwork. I also found that, among women, increased foodwork was associated with decreased time spent on personal care, socialising and hobbies, while this was not the case for men. Looking at trends over the survey years in Chapter 2, I found that the overall decline in foodwork was attributable to a decrease in participation and time spent by women, whereas men's foodwork had not declined significantly. While the decline of foodwork may be met with concern by advocates of home food preparation, it also represents a more equal (though still far from equal) division of responsibility for this labour between men and women.

7.2.2 Home-prepared food consumption and diet quality

My results suggest that increased consumption of home-prepared food is associated with higher dietary quality, which is consistent with existing evidence on the topic. However, my analyses, and my use of a food diary-based measure of proportion of energy from home-prepared food, allowed me to further explore this association.

Self-reported frequency of at-home main meal preparation is relatively high in the sub-sample of NDNS where this information was available: 71% of my adult sample reported that the main food provider in their household prepared a main meal at home every day of the week (see Chapter 4). However, this high frequency obscures a relatively small energetic contribution from home-prepared food. Using my food diary-based measure, where foods were categorised *a priori* as either home-prepared or not depending on a number of food diary variables, I estimated that, on average, participants derived around a quarter of their energy from home-prepared food (mean (SD) = 26.5% (12.1%)). These two findings are not necessarily inconsistent. My analysis in Chapter 4 suggests that the two measures are associated, although high frequency of at-home main meal preparation still equates to a relatively low proportion of energy from home-prepared food. While main meals (usually the evening meal) may often be home-prepared, other meals and snacks eaten throughout the day may not be, including meals assembled at home, but which I did not classify as home-prepared, such as cold cereal, toast or sandwiches, or meals and snacks purchased and consumed outside the home. Further, evening meals which participants may classify as home-prepared may include items which are not home-prepared, such as beverages, or frozen or otherwise pre-prepared side dishes or meal components. However, my finding of the low energetic contribution from home-prepared food highlights the many other sorts of foods eaten by adults living in the UK, which may be more important targets for dietary public health interventions. Further, it suggests even participants who prepare their main meals at home every day still obtain a lot of their energy from foods that are not home-prepared, meaning that these foods are important for the health of those who cook often as well as those who do not.

I further explored socio-demographic inequalities in both the proportion of consumption of home-prepared food and its association with dietary quality. While dietary quality varies considerably between different groups, the proportion of energy from home-prepared food was largely consistent across the variables I examined: gender, age, income, education level and occupational grade. Further, the association between home-prepared food consumption and dietary quality did not vary across these different groups. An exception to this was ethnicity, with White participants consuming significantly less energy from home-prepared food than participants of other ethnicities. The association between home-prepared food consumption and dietary quality may also be different in these groups, though the small proportion of participants of colour in the sample made it difficult to draw conclusions. However, with regard to dietary inequalities across other population sub-groups, these results do not support the idea that differences in consumption of home-prepared food is a key contributor.

Finally, given the relatively low proportion of energy from home-prepared food consumed by participants, and the possibility that, in light of the findings presented in Chapter 2, foodwork (including home food preparation) is continuing to decline among UK adults, I investigated the possibility of achieving high dietary quality with minimal consumption of home-prepared food. I did this by identifying individuals in NDNS who fell into this category: 7% of adult NDNS participants were in the top tertile for dietary quality, while being in the bottom tertile of proportion of energy derived from home-prepared foods. While these individuals had a high dietary quality overall, they still consumed a substantial amount of sugar and salt, highlighting the need for continued reformulation to reduce the quantities of these nutrients in the food supply. Further, these individuals are all relatively affluent, suggesting that the affordability of healthier foods that do not require home preparation may need to be addressed.

7.3 Strengths and limitations

This work uses data from several large, population-representative national surveys. Survey weights were applied to the data, including a novel approach to weighting compositional data, in the aim of providing reasonably reliable population-level estimates of adults living in the UK. The diary data used throughout this thesis was not only broad in the sense of being reasonably population-representative, but also rich and detailed, providing the scope to design analyses which took into account a broad range of characteristics pertaining to participants' time use and dietary intake. However, I also experienced the limitations of working with existing data as, beyond selecting the data sets that seemed most relevant in answering my questions, I had no control over the parameters of data collection. It would have been interesting to be able to include earlier time use surveys in my analysis in Chapter 2, but this was not possible due to the differences in data collection which I discussed there. Further, the data sets precluded any substantive analysis of the food practices and dietary intake of people of colour living in the UK, due to their relatively small numbers in NDNS and the exclusion of information on ethnicity in some of the UK time use surveys, including the most recent one.

While this thesis explores issues that have been addressed in previous research, such as time allocated to foodwork, and the association between home-prepared food consumption and diet quality, it introduces some innovations to how these issues can be approached. First, it uses a compositional data analysis approach to analyse time spent on foodwork not in isolation, but in conjunction with other uses of time. Second, it introduces a novel approach to measuring home-prepared food consumption using food diaries.

However, the task of interpreting the findings of this thesis as a whole is rendered somewhat challenging due to the distinct, though related, constructs which are deployed in the chapters. The analyses using data from time use diaries refer to foodwork, while the analyses of dietary data refer to home-prepared food. As discussed throughout this thesis, home-prepared food may be understood as the food produced by a certain type of foodwork. Even time coded as ‘food preparation’ in the time use diaries may not refer to home food preparation in the narrower sense prescribed by my definition of home-prepared food, as it may refer to heating prepared foods or assembling ready-made components. Thus, while the concepts of time spent on foodwork and home-prepared food consumption are certainly related, it is important to bear in mind that they are not identical, and that different sets of food practices may moderate the association between the two. However, both are key dimensions of home food preparation, and provide insight into how it is incorporated into people’s daily practices and their diets.

All of the analyses presented here are of cross-sectional or repeated cross-sectional data. Therefore, while they provide insight on time use and dietary intake in the population, and how these vary between different groups, it is not possible to draw conclusions surrounding what the impact of an increase in foodwork or the consumption of home-prepared food might be. While the results of Chapter 5 show that consuming more home-prepared food is associated with higher diet quality, it does not necessarily follow that increasing home-prepared food consumption, without targeting other components of dietary intake, would lead to significantly higher diet quality. Similarly, while participants who do no foodwork spend more time sleeping, as shown in Chapter 3, it cannot be concluded that an intervention to increase the amount of time an individual devoted to foodwork would result in less time being allocated to sleep. Longitudinal and experimental data are needed to further assess some of the hypotheses yielded by these results.

A final, but key, limitation to these analyses is the relative invisibility of the cognitive domain of foodwork. Chapters 2 and 3 focus on time allocated to the substantive activities of foodwork: home food preparation and management, washing dishes and clearing up, and shopping for food. Underpinning this labour is a substantial amount of cognitive work, orchestrating a perpetually evolving rota of meals and snacks. However, the time use data included in this thesis allows fairly limited insight into this cognitive work. Meanwhile, Chapters 4, 5 and 6 explore consumption, which may be understood as the endpoint of foodwork across all its domains, including more cognitive aspects.

Inequality in the cognitive domain of foodwork must also be considered. The work presented here is a social epidemiology, which has attempted to map socio-economic and demographic variation in foodwork and home-prepared food. However, it must be noted that this cognitive dimension of foodwork, which has not truly been explored in this work, may also be unequally spread. While the foodwork captured by the time use diaries reveals some inequalities, particularly between men and women, it probably also conceals inequalities. As noted in discussing the results of Chapter 3, Cains and Johnston show how their female participants frame and facilitate foodwork tasks undertaken by their male partners.[179]

While this work does not consistently identify inequalities across socio-demographic groups, this may in part be attributable to the limitations of the variables that could be measured. For example, cognitive work may also be variable between individuals who have more or less money available to devote to food: where money is scarcer, there may be a need for more explicitly strategic thinking in managing the food budget and avoiding or minimising food waste that can be ill-afforded. Comparing, for example, the ethnographic work carried out by Bowen, Brenton and Elliott with low-income and poor mothers[86] to the research conducted by Trubek among a more middle-class group[16] reveals some stark differences in food provisioning strategies. Bowen and colleagues talk about very careful food budgeting, systematic use of supermarket coupons, and regular visits to multiple stores to get the best deals. In contrast, Trubek's account of cooking practices place a lot of emphasis on creativity and spontaneity, with meals guided by ingredients available in the kitchen or things that looked appealing in the shops. To some extent, this reflects the scholars' individual concerns: Trubek is a trained chef and an unapologetic advocate of home cooking, not only for health but as a source of identity, joy and self-esteem. Meanwhile, Bowen, Brenton and Elliott's work articulates the idea that advocating for home-cooked family meals as a road to good health and broader wellbeing is a means of blaming individuals for problems that are in fact systemic. Nevertheless, it also seems plausible that their different portrayals reflect the more substantial cognitive efforts that must be made to provision food where financial resources are more limited.

7.4 Interpretation of findings and implications for research and practice

The rising prevalence of diet-related disease has put a spotlight on domestic food practices, sparking public discourse and dietary guidelines encouraging the public to cook more often or more healthily, and interventions aimed at developing food and cooking skills and changing behaviour. Meanwhile, changing economic and environmental realities continue to impact what happens in the home, altering food practices and intake: the foods we have access to, along with the ways our days are organised temporally and geographically, are changing. A recent analysis of North American news media by Oleschuk highlights this paradoxical logic at work: while media discourse recognised that the food system made it difficult for people to eat healthily, particularly for those on lower incomes, it nevertheless prescribed solutions that left individuals responsible for dietary intake and health outcomes.[251]

With this contrast, between a changing world and an exhortation to maintain continuity in food practices despite it, in mind, I now return to broader questions which persist in determining the relevance and importance of advocating and intervening in the field of home food preparation practices, as outlined in Chapter 1. These questions are:

1. Is it necessary?
2. Is it feasible?
3. Is it fair?

The analyses presented in this thesis responded to the specific research aims of this thesis, as outlined in the summary of findings presented above (7.2 Summary of findings), but they also make contributions to these overarching questions. While it would be an overstatement to claim that the results presented in this thesis provide conclusive answers to these key questions, the following section will discuss the contributions they make, and the implications they have for research and practice.

7.4.1 Is it necessary?

The results presented here suggest that foodwork continues to play an important role in the daily lives of adults living in the UK. While participation in foodwork has decreased over time, 72% of the population continues to do foodwork on a daily basis. Home food preparation is, as discussed, a subset of foodwork broadly defined. Existing evidence, however, suggests that home-prepared food continues to be eaten regularly in most households in the UK, at least until recently: analysis of data from the UK National Diet and Nutrition Survey (2008-2009) observed that 83.9% of adults lived in a household where a main meal was prepared at home five or more days of the week.[168] This evidence is consistent with arguments that the cooking 'crisis' has sometimes been overstated.[27]

However, the measure of home-prepared food consumption presented in Chapter 4 highlights that, while many people continue to do foodwork and eat home-prepared meals, home-prepared food actually makes up a relatively low proportion of energetic intake, at 26.5%. This may in part reflect that not all of time captured as 'foodwork' in the time use diaries is strictly home food preparation, although the frequency with which UK adults report eating home-prepared meals[168] suggest that home food preparation does occur with relative frequency. A more important mechanism may be the allocation of a substantial amount of time to producing a small amount of the calories consumed, which may reflect the social and cultural significance of home-prepared meals. However, if the decline in participation in foodwork, which, as shown in Chapter 2, has continued into the early 21st century, persists into the future, it may mean that the proportion of energy from home-prepared food will also decline. Further, the results presented in Chapter 4 also suggest that even those who prepare meals at home frequently derive a lot of their energetic intake from foods that are not home-prepared, suggesting that even an effective intervention to increase the frequency of home food preparation might not radically change these proportions.

Given these findings, Chapter 6 explored whether it was possible to have high dietary quality while obtaining a minimal proportion of energy from home-prepared food. While the data suggested it was possible, as a proportion of the sample did exactly that, further analysis provided insight into how this strategy could be made healthier and more broadly available to the population. While the group that consumed less home-prepared food had high diet quality overall, they consumed more salt and sugar than their counterparts who ate more home-prepared food, suggesting that an important aspect of making foods that are not home-prepared healthier is reducing their salt and sugar content, work which is already under way in salt and sugar reduction programmes in different countries around the world.

I also hypothesised that eating healthily while eating very little home-prepared food might be expensive. In the analytic sample, composed of individuals with high diet quality, participants who ate very little home-prepared food were not significantly more affluent than those who ate a lot of home-prepared food. However, given that this analytic sample was generally affluent, it is likely that their food practices were not primarily shaped by financial constraints.[16] Certain mechanisms already exist which may offer people the chance to eat healthily and affordably without preparing food at home, including school and workplace canteens, and collective or commensal meals held in community spaces.[86,105] Meanwhile, while we know that healthy foods are broadly more expensive than unhealthy foods,[189] evidence around how this plays out in foods that do not require home preparation is less conclusive: two studies of the healthiness and cost of UK ready meals drew conflicting conclusions, with one concluding that healthy ready meals were not more expensive, and the other concluding that they were.[206,207] An important gap seems to be examining the foods people actually eat, perhaps, as here, using dietary survey data, and determining the cost of the high diet quality, minimal home-prepared food strategy. This might help to determine whether interventions would do well to focus on healthy pre-prepared foods which are also affordable.

Further, while Chapter 6 identified participants who ate healthily while consuming a minimal amount of home-prepared food, it is not clear whether this translates into health outcomes similar to those of the group who ate healthily while eating a lot of home-prepared food. While the low home-prepared food group had high dietary quality as indicated by their overall DASH scores, the results also suggest that their intake of sugar and salt were relatively high. Longitudinal analysis would be required to clarify whether these different patterns are associated with any substantial differences in health outcomes.

Finally, while the necessity of home food preparation for health remains open to debate, food practices have importance and value beyond their importance to nutrition. Foodwork is part of the work of building culture, community and family, and an important way of showing care.[86,169,179,249,252] However, commensal eating does not necessarily imply ‘home cooking’ in the traditional sense, as evidenced in community meal initiatives, where the guests often do not prepare the food, which is instead prepared (sometimes by strangers) in an industrial kitchen,[105,109,253] or in Warin’s work, where families eat convenience foods together, using them as a way to demonstrate care.[114] In addition, forming connections with others and expressing care does not necessarily have to centre around food. Research on the benefits of eating together has often focused on families, finding that, while family meals are important to child wellbeing, so are other forms of family time.[254] Further, family meals may not be beneficial for all families, particularly in households where bonds between parents and children are weak,[255] and negotiating shared meals may sometimes be a source of conflict.[256] Meanwhile, in single-person households, which in the UK are increasingly common, eating meals outside the home may be an important way of connecting with others, as in the case of going out to eat with friends, or eating at a community dinner to connect with the local community.

Nevertheless, cooking and preparing food at home remains an important part of daily life, continuing to act as a way of expressing care, community and family. Concerns around the decline of cooking have often centred on the loss of culinary skills, as has been discussed by Short, with more ‘traditional’ food skills being replaced by “ever more routinised and depersonalised ‘cooking’ reliant on processed, prepared food”.[26] However, evidence suggests that people continue to cook more elaborate meals to celebrate special occasions,[16,26,86] implying that the ‘craft’ of cooking persists. While the diversification of food outlets and products makes it unsurprising that these options are being integrated into food practices, this does not mean that cooking and home food preparation will disappear.

7.4.2 Is it feasible?

Although, as noted above, there may be less of a cooking ‘crisis’ than is sometimes argued, understanding why people are preparing meals at home less frequently, as evidenced by the reduction in participation in foodwork, as well as reduced time spent and number of episodes of foodwork, shown in Chapter 2, is key to understanding whether there are interventions that could effectively change this practice at the population level.

As noted in Chapter 1, interventions to increase home food preparation frequency or change home food preparation practices have often taken the form of cooking classes and workshops, with the implicit or explicit aim seeming to be addressing a lack of skill in the population. However, evidence of the success of such interventions lacks the robustness to enable strong conclusions to be drawn,[87–89,257] and it is not clear that a loss of skill is a key driver for changes in home food preparation practice, particularly given the fact, discussed above, that many can and do prepare more elaborate meals for special occasions which depend on a substantial amount of skill.

Getting a true understanding of the feasibility of intervening in home food preparation practices is more easily done through intervention studies, while the work presented here is observational. Instead, this thesis has contributed to hypotheses about the feasibility of different approaches to intervening in this area by focusing on a lack of time as one of the most frequently cited barriers[46,115,116] to home food preparation, although, as noted above (7.3 Strengths and limitations), the time use diary data does not make it possible to tease out home food preparation specifically within the domains of foodwork that could be measured. Attempts at addressing this barrier by public health researchers and organisations have sometimes taken the form of providing people with ‘quick’ recipes,[117] an approach based on a fairly literal understanding of what is meant by a lack of time.

However, the findings presented here do not offer strong confirmation of this understanding. Although, as the compositional data approach explicitly recognises, everyone has the same number of hours in the day, the experience of lacking time may be reasonably expected to be associated with an increase in time allocated to work, both paid and unpaid, as time that is both non-discretionary, and has also been found to be on one of the dimensions of time use more strongly associated with self-rated feelings of rushedness.[145] However, as shown in Chapter 2, time allocated to foodwork has decreased significantly in the UK over the last 30 years, while time allocated to work has not increased. Instead, screen time and sleep have increased significantly and substantially. This suggests that other mechanisms may be at work, such as the increasing normalisation of the consumption of foods that are not home-prepared, or the desire for more time to spend on rest and leisure.

My findings show some evidence, in the lower time allocated to foodwork among economically active participants compared to economically inactive ones, of the role increased demands on time (in the form of work) play in shaping time allocated to foodwork. However, my results broadly suggest that, for the most part, the adult population of the UK is not being prevented from doing foodwork by the increased demands of other forms of work. If that were the case, it might be expected that time spent on work increased over time in tandem with the decrease in time spent on foodwork, which we did not see. We might also expect to see participants who do less foodwork allocating more time to work, when in fact we saw the reverse.

In light of these findings, it is worth re-evaluating what people mean when they say they do not have the time to prepare food at home. Understanding what form this barrier really takes in people's lives is key to understanding which interventions might work. Qualitative work on the topic, which goes beyond existing work that identifies barriers,[45,46] and focuses more deeply on how a perceived lack of time operates as a barrier, and how interventions could help to address it, would be useful in taking this further.

Looking at food practices from the perspective of time use data, as opposed to focusing exclusively on nutritional data, highlights the complexity of the context in which they operate. Trubek phrases this concisely in saying that cooking exists in a ‘richly structured’ environment.[16] If we are intervening to encourage people to prepare more meals at home, we are ‘competing’ not only with other sources of food (restaurants, takeaways, prepared ready meals and snacks), but also with other potential ways of spending time. If saying “I don’t always have the time to cook” is shorthand for “Sometimes, there are other things I would rather do with my time”, as might be suggested by, for example, the increase in leisure screen time over the past 30 years, then interventions of a different sort are needed. These might focus more, as mentioned above, on making the food options that are not home-prepared healthier, while keeping them affordable and accessible.

Conversely, what is referred to as a lack of time may be something more akin to an excessive cognitive load, which some have attributed to the erosion of social structuring of food practices, making these practices much more unstructured and individualised.[258] Interventions to address this could take the form of reducing the large number of choices that need to be made in navigating the contemporary food environment. Recipe box subscriptions or fruit and vegetable box schemes are existing systems that people opt in to, which may reduce the number of food-related decisions they are required to make. Meal planning and making grocery lists, which have been shown to be associated with higher diet quality,[78,259] may also be a way of reducing the number of decisions that need to be made, or at least enabling these decisions to be made outside of the supermarket environment, which is generally designed to maximise profit rather than health.[260–262] However, these changes, like changes in home food preparation behaviours, would most likely rely on education-based interventions, and may encounter similar difficulties of requiring a substantial amount of agency, being difficult to scale to the population level, and being difficult to sustain in the face of external stressors.

7.4.3 Is it fair?

Finally, the equity repercussions of advocating for increased frequency of home food preparation, and intervening to change home food preparation practices, must be considered. As previously discussed, interventions to increase the frequency with which people prepare food at home or to change the nature of their home food preparation practices have mainly consisted of cooking classes and workshops. Such interventions may be classified as highly ‘agentic’: their success relies on individuals using their personal resources, or ‘agency’.[263–265] The improvement relies on an individual going to the class, learning the material in hand, and applying the material in their home cooking practice in a sustained way. The effectiveness of interventions that rely on this mechanism has been questioned, and it has been suggested that they may exacerbate inequalities in health and disease.[263–265] If interventions in this area continue to be centred around cooking classes, their repercussions for health inequalities should be taken into consideration. Reviews of interventions to promote a healthy diet have concluded that interventions that target individual behaviour,[266] and that rely on the provision of information and education to individuals (a category in which the authors included cooking lessons),[267] were less likely to address socioeconomic inequalities and dietary intake, and could even exacerbate them. Food and cooking education based in schools would be a less highly agentic approach as being part of a mandatory programme of education, but the extent to which students would be able to apply their knowledge outside of school or in later life might still be different for different groups: an evaluation of a cooking intervention in English primary schools found that the impact of the intervention on cooking confidence was reduced in schools in more deprived areas, though their other outcome, vegetable consumption, did not vary by school deprivation.[99]

Cooking interventions often target groups known to have, in general, a lower dietary quality, such as men[202] and less affluent individuals,[203] suggesting that worse dietary quality in these groups is suspected to be attributable to a lack of skill. An implicit assumption that some groups either eat less home-prepared food, or that the home-prepared food they eat is somehow less healthy, may underpin this targeting of interventions. These interventions may also represent a belief that less affluent groups *should* eat at home, as the only way to eat healthily while staying within their income.[251,268,269] Regardless of the fairness of such beliefs, the evidence presented in Chapter 5 suggests that the consumption of home-prepared food does not play a key role in nutritional inequalities. Between most social groups, the proportion of energy from home-prepared food did not vary substantially, nor did its association with overall diet quality. Nevertheless, substantial socio-demographic inequalities in dietary quality were present in the sample, as well as almost universally in nutrition research.[241] This suggests that other components of the diet, such as meals eaten out of home or prepared foods, drinks and snacks, are more important in determining dietary inequalities, than some groups cooking less often or less healthily than others. Interventions that help to make these items healthier, as well as affordable and accessible, might be more effective in addressing inequalities in diet.

Last, inequality in who will be expected to, or will actually, shoulder the burden of changing home food preparation practices must not be ignored. When discussing foodwork, the issue of gender is ever present, and the findings presented in Chapter 2 show that women continue to do more foodwork than men. However, the decline in participation in foodwork is principally attributable to a decline in women's participation: men's participation in foodwork has not changed significantly. Thus, while declining participation in foodwork may be a cause for concern among advocates of home food preparation, there is also a positive dimension in that men are doing, if not a larger absolute amount, then a larger proportion of foodwork. The findings in Chapter 2 also suggest that spending more time on foodwork is associated with different patterns of time allocation between men and women. Where women who spent more time on foodwork spent less time on personal care, socialising and hobbies, this was not the case for men. While men and women who did no foodwork spent a similar amount of time on work overall, women who did more foodwork spent substantially more time (61 minutes) on work overall than men who did more foodwork. Taken together, these findings suggest that men who do more foodwork add less to their overall workload, perhaps because work is shared with other household members, allowing them to take more responsibility for foodwork without losing time to spend on leisure activities. This does not appear to be the case for women. As this work is cross-sectional, longitudinal analysis to determine how people re-structure their time use in response to devoting more or less time to foodwork would be useful to confirm this hypothesis. Finally, as discussed above (7.3 Strengths and limitations), the inequality in the burden of foodwork revealed by these data is likely to only be part of the issue, with inequality also existing in the more cognitive domains of household labour, as suggested by existing research.[270]

Given the likelihood of women doing more than their equal share of foodwork, and also substantial evidence that women experience more guilt around not doing foodwork ‘right’ and are held responsible as gatekeepers of family and household health,[18,179,269,271] interventions that seek to change home food preparation practices must explicitly integrate approaches to address gender-based inequalities. Gender justice is sometimes compromised in an attempt to achieve public health outcomes: Reiheld recounts how many dietary interventions mobilise mothers and even grandmothers in attempting to change dietary behaviours.[271] Admittedly, this corresponds with how women sometimes see themselves: several studies have reported a certain ambivalence around foodwork, as a source of stress and resentment, but also as a source of pride and an important part of some forms of feminine identity.[18,179,272] While this association can be recognised in thinking about how to support people to eat more healthily, it is important that it not be couched in what Gill and Orgad recently called a discourse of “resilience”: a quality “demanded and promoted by public policy in the context of austerity and worsening inequality”, exemplified, for example, by the slogan ‘make do and mend’, and particularly demanded of and expected in women.[273] This resilience logic often seems to be at work in discourses surrounding foodwork, exemplified in statements like “everyone has time to cook”,[274] or beliefs that getting organised, planning ahead, sacrificing a bit of leisure time or working a bit harder is an easy fix to achieve a healthy diet. As Gill and Orgad note, resilience is often portrayed as a quality that is somehow passive, or endlessly replenishable, when it is in fact active and involves extensive physical, affective and intellectual labour.[273] An ethnographic account of a relatively affluent mother’s approach to feeding her family, as recounted by Bowen, Brenton and Elliott,[86] seems to exemplify this. The participant, who was employed full-time, deployed all of the strategies advocated to feed a family well, such as getting organised by planning meals ahead of time, preparing meal components in the evenings, batch cooking on the weekends, and ‘voting with her fork’ by choosing foods that were in keeping with her ethical principles. This was not only a financially costly strategy, it was also one that involved a large amount of effort. The derailing of this strategy by routine events, such as visits from relatives, or commitments at work or school, which is recounted reveals the substantial work it requires. Even where financial resources were relatively plentiful, the strategy could not be maintained under moments of external stress. Dietary interventions must eschew discourses of resilience as unhelpful, and instead address tangible barriers to healthy eating.

7.5 Conclusion

In the hope of improving diet quality at the population-level or in particular population sub-groups, substantial energy has been devoted to understanding the modifiable determinants of home food preparation, to advocating for increased home food preparation, and to intervening in home food preparation practices. However, a number of issues persist both in the epidemiological literature and the public health application of the evidence. This thesis aimed to address two key issues in the study of home food preparation: how a lack of time operates as a barrier to foodwork, including home food preparation, and the relationship between home-prepared food consumption and diet quality.

My analyses of time use among adults living in the UK suggest that foodwork has continued to decline in the 21st century, with participation in foodwork and, among those who do foodwork, the number of daily episodes and amount of time allocated to foodwork, have all declined. A lack of time, which may be understood as excessive demands on time in the form of paid and unpaid work, is often conceived of as being particularly characteristic of contemporary life, and as a result these demands might be expected to occupy the time that was once allocated to foodwork. However, my evidence does not support this as a key mechanism in how foodwork has changed over the past three decades, as there was no concurrent increase in time allocated to work. I also found that foodwork, while continuing to be very gendered in my most recent data, has come to be somewhat more evenly shared between men and women. While time use may reflect material constraints, it may also reflect changing social norms around how to spend time, who does foodwork, and what foods are acceptable to eat.

In exploring the relationship between home-prepared food consumption and dietary quality I found, in line with existing research on the topic, that increased consumption of home-prepared food was associated with moderately higher dietary quality. However, my analyses, along with my novel approach to estimating home-prepared food consumption, suggested that only a quarter of participants' energy intake was derived from home-prepared food. Further, my findings did not support the idea that home-prepared food plays a substantial role in dietary inequalities, given that neither the quantity of home-prepared food consumed nor its association with overall dietary quality varied substantially across most population sub-groups. Despite this, dietary quality varied considerably across these groups, suggesting that other components of diet may play a more substantial role. Finally, in light of the low proportion of energy derived from home-prepared food and the persistent decline in time allocated to foodwork, I explored whether it was possible to have high dietary quality with minimal consumption of home-prepared food. Using nationally representative dietary survey data, I identified individuals who did so, suggesting that such a strategy is available to, and used by, some. Further analysis suggested that these individuals, despite high overall diet quality, consumed a lot of salt and sugar, suggesting a continued role for reformulation to reduce the salt and sugar available in the overall food supply. Finally, these individuals were all relatively affluent, which supports existing evidence that all healthy food, including foods that do not require home preparation, need to be made more affordable.

As a whole, this work suggests that, while foodwork and home food preparation continue to play an important role in how people in the UK spend their time and access their food, other ways of eating also play an important, and potentially growing, role. Interventions that seek to improve dietary quality at the population level must take a full account of contemporary life, supporting individuals in eating healthily through a diverse range of approaches to food.

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9 Appendices

APPENDIX 1: SUPPLEMENTARY MATERIALS FOR CHAPTER 2

The 68 activity codes used in the UK data sets harmonized as part of the Multinational Time Use Study were included in the eight compositional parts as follows:

Imputed personal and household care	Work
Sleep or nap	Sleep
Imputed sleep	Sleep
Wash/dress/care for self	Personal care
Meals at work or school	Eating
Other meals	Eating
Paid work, main job (not at home)	Work
Paid work at home	Work
Second or other job not at home	Work
Unpaid work to generate household income	Work
Travel as a part of work	Work
Work breaks	Work
Other time at workplace	Work
Look for work	Work
Regular schooling, education	Work
Homework	Work

Leisure/other education or training	
Food preparation/ cooking	Foodwork
Set table, wash or put away dishes	
Cleaning	Work
Laundry, ironing, clothing repair	
Home/vehicle maintenance or improvement	
Other domestic work	
Purchase goods and general consumption activities	
Consume personal services	
Consume other services	
Pet care (not walk dog)	
Physical, medical child care	
Teach, help with homework	
Read to, talk or play with child	
Supervise, accompany, other child care	
Adult care	
Voluntary, civic, organisational activity	Socialising and hobbies
Worship and religion	

General out-of-home leisure	
Attend sporting event	
Cinema, theatre, opera, concert	
Other public event, venue	Socialising and hobbies
Restaurant, café, bar, pub	
Party, reception, social event, gambling	
Imputed time away from home	
General sport or exercise	Physical activity
Walking	
Cycling	
Other out-of-doors recreation	
Garden, forage (pick mushrooms), hunt/fish	
Walk dogs	
Receive or visit friends	Socialising and hobbies
Conversation (in person, phone)	
Other in-home social, games	
General indoor leisure	
Artistic or musical act	

Written correspondence	
Knit, crafts, hobbies	
Relax, think, do nothing	
Read	
Listen to music, Ipod, CD	
Listen to radio	
Watch TV, DVD, video	Leisure screen time
Play computer games	
Send e-mail, surf internet, computing	
No activity but recorded mode of travel	Work
Travel to or from work	
Education-related travel	
Voluntary, civic, religious travel	Socialising and hobbies
Child & adult care travel	Work
Shopping, personal & household care travel	
Other travel	

Pattern of zeroes in the time-use composition

Among participants who reported spending time on foodwork, the most common pattern of time-use composition saw individuals reporting doing all activities except physical activity (34%), then all activities (20%), then all activities except physical activity and hobbies and socialising (10%). For physical activity, there were a large number of zero values (66% of participants). For other activity categories, there were a smaller number of zero values: 21% for hobbies and socialising, 19% for leisure screen time, 3% for personal care, 2% for eating, and 2% for work. There were no zero values for sleep as diaries reporting zero minutes of sleep were excluded in the quality control procedures. There were also no zero values for foodwork as this portion of the analysis only applied to participants who reported engaging in foodwork.

Among participants who reported spending no time on foodwork, the most common pattern of time-use composition saw individuals reporting doing all activities except physical activity (42%), then all activities (32%), then all activities except physical activity and hobbies and socialising (6%). For physical activity, there were a large number of zero values (58% of participants). For other activity categories, there were a smaller number of zero values: 11% for leisure screen time, 10% for hobbies and socialising, 8% for personal care, 7% for work, and 5% for eating. There were no zero values for sleep as diaries reporting zero minutes of sleep were excluded in the quality control procedures.

Table A1: Model-adjusted compositional means (mins/day) by sample year for whole sample (participants who reported spending time on foodwork and participants who did not report spending time on foodwork)

Parts	Whole sample					
	Foodwork			No foodwork		
	1983	2000	2014	1983	2000	2014
Personal care	56.14	47.22	54.57	55.98	49.97	58.99
Sleep	602.78	632.91	652.65	713.16	762.41	774.21
Eating	92.53	84.42	83.06	101.44	85.26	99.44
Physical activity	6.11	11.43	9.84	4.57	8.42	6.49
Leisure screen time	117.32	127.05	170.88	85.11	100.06	121.27
Work	295.44	334.43	310.11	278.63	283.01	291.21
Socialising and hobbies	173.52	131.64	86.98	201.12	150.88	88.39
Foodwork	96.17	70.90	71.90	0.00	0.00	0.00

Table A2: Log-ratio difference between groups and bootstrapped confidence intervals for whole sample (participants who reported spending time on foodwork and participants who did not report spending time on foodwork)

Parts	**Whole sample**											
	Foodwork						No foodwork					
	2000 vs 1983		2014 vs 2000		2014 vs 1983		2000 vs 1983		2014 vs 2000		2014 vs 1983	
	LR[a]	CI[b]	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI
Personal care	-0.17	-0.24, -0.11	0.14	0.10, 0.18	0.04	-0.05, 0.13	-0.11	-0.24, 0.03	0.16	0.08, 0.25	0.06	-0.13, 0.25
Sleep	0.05	0.02, 0.07	0.03	0.02, 0.05	0.08	0.05, 0.11	0.06	0.00, 0.13	0.02	-0.02, 0.05	0.09	0.01, 0.17
Eating	-0.10	-0.16, -0.03	-0.02	-0.06, 0.02	-0.08	-0.16, 0.00	-0.18	-0.32, -0.04	0.15	0.06, 0.23	-0.02	-0.20, 0.16
Physical activity	0.63	0.47,	-0.16	-0.28,	0.49	0.27,	0.59	0.25,	-0.28	-0.49,	0.50	0.07,

		0.79		-0.03		0.71		0.94		-0.06		0.95
Leisure screen time	0.08	-0.02, 0.19	0.29	0.22, 0.26	0.37	0.23, 0.51	0.15	-0.11, 0.41	0.20	0.05, 0.35	0.35	0.05, 0.66
Work	0.12	0.05, 0.20	-0.07	-0.11, -0.03	0.03	-0.07, 0.12	0.03	-0.15, 0.22	0.03	-0.07, 0.13	-0.01	-0.22, 0.21
Socialising and hobbies	-0.27	-0.38, -0.17	-0.42	-0.49, -0.35	-0.63	-0.78, -0.49	-0.28	-0.52, -0.02	-0.55	-0.71, -0.38	-0.75	-1.07, -0.42
Foodwork	-0.30	-0.36, -0.23	0.01	-0.03, 0.06	-0.31	-0.40, -0.22	-	-	-	-	-	-

Table A3: Model-adjusted compositional mean (min/day) by sample year for whole sample and population sub-groups (participants who reported spending time on foodwork ONLY)

Parts	**Whole sample**			**Gender**					
				Men			Women		
	1983	2000	2014	1983	2000	2014	1983	2000	2014
Personal care	56.14	47.22	54.57	50.61	41.28	44.82	57.40	49.19	59.16
Sleep	602.78	632.91	652.65	640.59	648.97	678.59	576.48	621.33	633.28
Eating	92.53	84.42	83.06	93.08	79.93	79.90	88.43	84.10	81.86
Physical activity	6.11	11.43	9.84	11.19	16.53	14.94	4.47	9.11	7.49
Leisure screen time	117.32	127.05	170.88	169.67	178.17	229.34	92.66	102.06	141.68
Work	295.44	334.43	310.11	212.32	272.93	240.49	317.43	350.31	337.22

Socialising and hobbies	173.52	131.64	86.98	191.77	144.35	89.22	176.26	133.87	92.50
Foodwork	96.17	70.90	71.90	70.77	57.85	62.71	126.87	90.02	86.79

Table A3: Model-adjusted compositional means (mins/day) by sample year for whole sample and population sub-groups (participants who reported spending time on foodwork) (continued)

	Economic activity						**Educational attainment**								
Parts	Active			Inactive			Less than secondary			Completed secondary			Above secondary		
	1983	2000	2014	1983	2000	2014	1983	2000	2014	1983	2000	2014	1983	2000	2014
Personal care	56.12	45.74	53.17	56.39	47.31	55.39	56.76	45.38	60.27	57.59	47.72	56.22	50.71	48.86	53.75
Sleep	601.99	609.56	635.48	594.52	630.50	648.79	607.46	642.25	658.05	602.75	636.21	663.26	601.72	615.33	638.32
Eating	85.99	71.98	71.11	97.66	96.67	96.22	98.76	88.98	91.97	92.78	80.75	73.73	87.43	86.50	88.70
Physical activity	5.89	9.76	8.63	6.04	12.96	10.60	5.88	10.91	9.36	6.13	11.60	8.85	6.09	11.17	10.38

Leisure screen time	105.34	102.49	138.41	122.93	145.32	198.95	130.24	139.15	171.21	120.29	135.76	180.51	95.64	105.41	146.64
Work	362.25	445.81	407.28	229.35	239.34	229.35	260.37	306.34	290.97	314.19	343.69	308.86	323.95	346.02	331.67
Socialising and hobbies	143.78	98.03	65.19	214.10	178.02	119.37	174.90	128.92	94.28	164.22	114.85	77.09	184.43	161.74	103.17
Foodwork	78.64	56.62	60.73	119.02	89.87	81.34	105.63	78.06	63.90	82.04	69.41	71.48	90.04	64.97	67.35

Table A4: Log-ratio difference between groups and bootstrapped confidence intervals (participants who reported spending time on foodwork ONLY)

Parts	**Whole sample**						**Gender**											
							Men						Women					
	2000 vs 1983		2014 vs 2000		2014 vs 1983		2000 vs 1983		2014 vs 2000		2014 vs 1983		2000 vs 1983		2014 vs 2000		2014 vs 1983	
	LR[a]	CI[b]	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI
Personal care	-0.17	-0.24, -0.11	0.14	0.10, 0.18	0.04	-0.05, 0.13	-0.21	-0.33, -0.09	0.08	0.01, 0.14	-0.04	-0.18, 0.10	-0.15	-0.24, -0.07	0.18	0.13, 0.23	0.10	-0.03, 0.23
Sleep	0.05	0.02, 0.07	0.03	0.02, 0.05	0.08	0.05, 0.11	0.01	-0.03, 0.05	0.05	0.02, 0.07	0.07	0.02, 0.13	0.07	0.04, 0.10	0.02	0.01, 0.04	0.09	0.04, 0.14

Eating	-0.10	-0.16, -0.03	-0.02	-0.06, 0.02	-0.08	-0.16, 0.00	-0.16	-0.27, -0.05	-0.01	-0.07, 0.06	-0.10	-0.23, 0.02	-0.06	-0.14, 0.03	-0.03	-0.08, 0.03	-0.07	-0.18, 0.05
Physical activity	0.63	0.47, 0.79	-0.16	-0.28, -0.03	0.49	0.27, 0.71	0.39	0.08, 0.69	-0.10	-0.30, 0.09	0.34	-0.01, 0.69	0.72	0.54, 0.91	-0.21	-0.36, -0.06	0.57	0.25, 0.87
Leisure screen time	0.08	-0.02, 0.19	0.29	0.22, 0.26	0.37	0.23, 0.51	0.05	-0.13, 0.23	0.25	0.15, 0.34	0.35	0.15, 0.56	0.11	-0.02, 0.24	0.33	0.24, 0.42	0.33	0.12, 0.54
Work	0.12	0.05, 0.20	-0.07	-0.11,	0.03	-0.07, 0.12	0.25	0.10, 0.42	-0.11	-0.19,	0.06	-0.10, 0.23	0.10	0.02, 0.18	-0.04	-0.09, 0.01	0.08	-0.06, 0.21

				-0.03						-0.03								
Socialising and hobbies	-0.27	-0.38, -0.17	-0.42	-0.49, -0.35	-0.63	-0.78, -0.49	-0.28	-0.47, -0.09	-0.49	-0.60, -0.37	-0.74	-0.96, -0.52	-0.27	-0.39, -0.15	-0.38	-0.47, -0.29	-0.55	-0.74, -0.36
Foodwork	-0.30	-0.36, -0.23	0.01	-0.03, 0.06	-0.31	-0.40, -0.22	-0.20	-0.32, -0.09	0.08	0.01, 0.16	-0.13	-0.27, 0.01	-0.34	-0.41, -0.26	-0.04	-0.09, 0.02	-0.45	-0.56, -0.33

Table A4: Log-ratio difference between groups and bootstrapped confidence intervals (participants who reported spending time on foodwork ONLY) (continued)

	Economic activity											
	Active						Inactive					
Parts	2000 vs 1983		2014 vs 2000		2014 vs 1983		2000 vs 1983		2014 vs 2000		2014 vs 1983	
	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI
Personal care	-0.21	-0.29, -0.12	0.14	0.09, 0.19	0.05	-0.06, 0.16	-0.16	-0.27, -0.06	0.16	0.08, 0.24	-0.01	-0.17, 0.14
Sleep	0.01	-0.02, 0.05	0.04	0.02, 0.06	0.05	0.01, 0.09	0.06	0.02, 0.09	0.03	0.00, 0.05	0.09	0.04, 0.14
Eating	-0.18	-0.27, -0.09	-0.02	-0.07, 0.03	-0.13	-0.24, -0.02	-0.01	-0.11, 0.09	0.00	-0.07, 0.07	-0.02	-0.15, 0.10

Physical activity	0.51	0.29, 0.73	-0.13	-0.27, 0.02	0.43	0.14, 0.71	0.74	0.50, 0.98	-0.21	-0.42, 0.01	0.61	0.25, 0.98
Leisure screen time	-0.02	-0.17, 0.14	0.30	0.22, 0.38	0.29	0.10, 0.48	0.17	0.01, 0.34	0.30	0.20, 0.41	0.45	0.24, 0.66
Work	0.21	0.11, 0.30	-0.09	-0.13, -0.04	0.07	-0.04, 0.20	0.03	-0.07, 0.14	-0.03	-0.12, 0.05	0.00	-0.15, 0.14
Socialising and hobbies	-0.38	-0.53, -0.22	-0.42	-0.51, -0.33	-0.72	-0.91, -0.52	-0.18	-0.31, -0.05	-0.40	-0.51, -0.29	-0.49	-0.69, -0.30
Foodwork	-0.32	-0.41, -0.24	0.07	0.01, 0.12	-0.24	-0.35, -0.12	-0.28	-0.37, -0.19	-0.10	-0.18, -0.01	-0.42	-0.55, -0.28

Table A4: Log-ratio difference between groups and bootstrapped confidence intervals (participants who reported spending time on foodwork) (continued)

Parts	Educational attainment																	
	Less than secondary						Completed secondary						Above secondary					
	2000 vs 1983		2014 vs 2000		2014 vs 1983		2000 vs 1983		2014 vs 2000		2014 vs 1983		2000 vs 1983		2014 vs 2000		2014 vs 1983	
	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI
Personal care	-0.22	-0.31, -0.14	0.29	0.16, 0.41	0.04	-0.12, 0.19	-0.19	-0.35, -0.02	0.16	0.10, 0.23	-0.03	-0.20, 0.13	-0.04	-0.19, 0.12	0.10	0.04, 0.15	0.06	-0.08, 0.21
Sleep	0.06	0.03, 0.09	0.03	-0.02, 0.08	0.06	0.00, 0.13	0.04	-0.01, 0.10	0.04	0.02, 0.06	0.12	0.06, 0.17	0.02	-0.03, 0.08	0.04	0.02, 0.06	0.06	0.01, 0.12

Eating	-0.10	-0.19, -0.02	0.04	-0.10, 0.17	-0.14	-0.30, 0.02	-0.14	-0.28, 0.00	-0.09	-0.16, -0.02	-0.22	-0.37, -0.07	-0.02	-0.15, 0.12	0.03	-0.03, 0.08	0.03	-0.10, 0.16
Physical activity	0.63	0.42, 0.84	-0.16	-0.59, 0.26	0.40	-0.10, 0.87	0.61	0.21, 1.01	-0.27	-0.45, -0.08	0.42	0.02, 0.83	0.58	0.20, 0.95	-0.08	-0.25, 0.09	0.58	0.23, 0.91
Leisure screen time	0.07	-0.07, 0.22	0.21	0.01, 0.39	0.23	-0.01, 0.46	0.14	-0.13, 0.43	0.29	0.18, 0.39	0.34	0.07, 0.63	0.10	-0.15, 0.35	0.33	0.24, 0.42	0.44	0.20, 0.69
Work	0.17	0.07, 0.27	-0.06	-0.23, 0.09	0.14	-0.07, 0.34	0.09	-0.09, 0.30	-0.11	-0.18,	0.01	-0.18, 0.22	0.07	-0.08, 0.23	-0.04	-0.10, 0.01	0.02	-0.12, 0.18

										-0.04								
Socialising and hobbies	-0.31	-0.44, -0.17	-0.32	-0.58, -0.08	-0.56	-0.86, -0.27	-0.34	-0.64, -0.03	-0.40	-0.53, -0.28	-0.78	-1.07, -0.47	-0.15	-0.35, 0.07	-0.45	-0.54, -0.36	-0.56	-0.74, -0.36
Foodwork	-0.30	-0.38, -0.22	-0.21	-0.37, -0.04	-0.49	-0.67, -0.31	-0.17	-0.32, -0.02	0.03	-0.04, 0.11	-0.09	-0.25, 0.08	-0.31	-0.45, -0.18	0.04	-0.02, 0.10	-0.28	-0.42, -0.15

[a]LR = Log-ratio difference *between* sample years, bold font signifies a statistically significant difference ($p<0.017$). Log-ratio differences are difficult to interpret numerically, and so in the text they are just presented as significantly higher or significantly lower. Numerically, a ‘significant’ difference is one where the confidence interval does not cross 0, the natural log of 1, indicating a ratio between equal proportions. Significant differences that are over 0 may be interpreted as significantly higher than the reference category, and significant differences that are under 0 may be interpreted as significantly lower than the reference category.

[b]CI = 98.3% confidence intervals constructed using a bootstrap technique; critical level was adjusted from 0.05 to 0.017 using the Bonferroni correction

APPENDIX 2: SUPPLEMENTARY MATERIALS FOR CHAPTER 3

The 273 activity codes used by the UK Time Use Survey were included in the seven compositional parts as follows:

0 Unspecified personal care	**Personal care**
110 Sleep	Sleep
111 Sleep: in bed not asleep	Sleep (unless secondary activity e.g. reading, watching television in which case coded to the relevant component)
120 Sleep: Sick in bed	
210 Eating	Eating
300 Other personal care: Unspecified other personal care	Personal care
310 Other personal care: Wash and dress	
390 Other personal care: Other specified personal care	
1000 Unspecified employment	
1100 Main job: unspecified main job	
1110 Main job: Working time in main job	
1120 Main job: Coffee and other breaks in main job	
1200 Second job: unspecified second job	

1210 Second job: Working time in second job	Work
1220 Second job: Coffee and other breaks in second job	
1300 Activities related to employment: Unspecified activities related to employment	
1310 Activities related to employment: Lunch break	
1390 Activities related to employment: Other specified activities related to employment	
1391 Activities related to employment: Activities related to job seeking	
1399 Activities related to employment: Other specified activities related to employment	
2000 Study Unspecified study school or university	
2100 Study Unspecified activities related to school or university	
2110 Study Classes and lectures	

2120 Study Homework	Work
2190 Study Other specified activities related to school or university	Work
2210 Free time study	Work
3000 Unspecified household and family care	Work
3100 Unspecified food management	Work
3110 Food preparation and baking	Work
3130 Dish washing	Work
3140 Preserving	Work
3190 Other specified food management	Work
3200 Unspecified household upkeep	Work
3210 Cleaning dwelling	Work
3220 Cleaning yard	Work
3230 Heating and water	Work
3240 Arranging household goods and materials	Work
3250 Disposal of waste	Work
3290 Other or unspecified household upkeep	Work

3300 Unspecified making and care for textiles	
3310 Laundry	
3320 Ironing	
3330 Handicraft and producing textiles	
3390 Other specified making and care for textiles	
3410 Gardening	
3420 Tending domestic animals	
3430 Caring for pets	
3440 Walking the dog	
3490 Other specified gardening and pet care	
3500 Unspecified construction and repairs	
3510 House construction and renovation	
3520 Repairs of dwelling	
3530 Making repairing and maintaining equipment	
3531 Woodcraft metalcraft sculpture and pottery	

3539 Other specified making repairing and maintaining equipment	
3540 Vehicle maintenance	
3590 Other specified construction and repairs	
3600 Unspecified shopping and services	
3610 Unspecified shopping	
3611 Shopping mainly for food	
3612 Shopping mainly for clothing	
3613 Shopping mainly related to accommodation	
3614 Shopping or browsing at car boot sales or antique fairs	Socialising and hobbies
3615 Window shopping or other shopping as leisure	
3619 Other specified shopping	Work
3620 Commercial and administrative services	
3630 Personal services	
3690 Other specified shopping and services	

3710 Household management not using the internet	Work
3713 Shopping for and ordering clothing via the internet	
3720 Unspecified household management using the internet	
3721 Shopping for and ordering unspecified goods and services via the internet	
3722 Shopping for and ordering food via the internet	
3724 Shopping for and ordering goods and services related to accommodation via the internet	
3725 Shopping for and ordering mass media via the internet	Leisure screen time
3726 Shopping for and ordering entertainment via the internet	
3727 Banking and bill paying via the internet	
3729 Other specified household management using the internet	

3800 Unspecified childcare	Work
3810 Unspecified physical care & supervision of a child	
3811 Feeding the child	
3819 Other and unspecified physical care & supervision of a child	
3820 Teaching the child	
3830 Reading playing and talking with child	
3840 Accompanying child	
3890 Other or unspecified childcare	
3910 Unspecified help to a non-dependent eg injured adult household member	
3911 Physical care of a non-dependent eg injured adult household member	
3914 Accompanying a non-dependent adult household member eg to hospital	
3919 Other specified help to a non-dependent adult household member	
3920 Unspecified help to a dependent adult household member	

3921 Physical care of a dependent adult household member eg Alzheimic parent	Work
3924 Accompanying a dependent adult household member eg Alzheimic	
3929 Other specified help to a dependent adult household member	
4000 Unspecified volunteer work and meetings	Socialising and hobbies
4100 Unspecified organisational work	
4110 Work for an organisation	
4120 Volunteer work through an organisation	
4190 Other specified organisational work	
4200 Unspecified informal help to other households	
4210 Food management as help to other households	
4220 Household upkeep as help to other households	
4230 Gardening and pet care as help to other households	

4240 Construction and repairs as help to other households	Work
4250 Shopping and services as help to other households	
4260 Help to other households in employment and farming	
4270 Unspecified childcare as help to other households	
4271 Physical care and supervision of child as help to other household	
4272 Teaching non-coresident child	
4273 Reading playing & talking to non-coresident child	
4274 Accompanying non-coresident child	
4275 Physical care and supervision of own child as help to other household	
4276 Teaching own non-coresident child	
4277 Reading playing & talking to own non-coresident child	
4278 Accompanying own non-coresident child	

4279 Other specified childcare as help to other household	Work
4280 Unspecified help to an adult of another household	
4281 Physical care and supervision of an adult as help to another household	
4282 Accompanying an adult as help to another household	
4283 Other specified help to an adult member of another household	
4289 Other specified informal help to another household	
4290 Other specified informal help	
4300 Unspecified participatory activities	
4310 Meetings	
4320 Religious activities	
4390 Other specified participatory activities	
5000 Unspecified social life and entertainment	
5100 Unspecified social life	

5110 Socialising with family	Socialising and hobbies
5120 Visiting and receiving visitors	
5130 Celebrations	
5140 Telephone conversation	
5190 Other specified social life	
5200 Unspecified entertainment and culture	
5210 Cinema	
5220 Unspecified theatre or concerts	
5221 Plays musicals or pantomimes	
5222 Opera operetta or light opera	
5223 Concerts or other performances of classical music	
5224 Live music other than classical concerts opera and musicals	
5225 Dance performances	
5229 Other specified theatre or concerts	
5230 Art exhibitions and museums	
5240 Unspecified library	

5241 Borrowing books records audiotapes videotapes CDs VDs etc from a library	
5242 Reference to books and other library materials within a library	
5243 Using internet in the library	Leisure screen time
5244 Using computers in the library other than internet use	Socialising and hobbies
5245 Reading newspapers in a library	
5246 Listening to music in a library	
5249 Other specified library activities	
5250 Sports events	
5290 Unspecified entertainment and culture	
5291 Visiting a historical site	
5292 Visiting a wildlife site	
5293 Visiting a botanical site	Socialising and hobbies
5294 Visiting a leisure park	
5295 Visiting an urban park playground designated play area	Physical activity

5299 Other or unspecified entertainment or culture	Socialising and hobbies
5310 Resting - Time out	Sleep
6000 Unspecified sports and outdoor activities	Physical activity
6100 Unspecified physical exercise	
6110 Walking and hiking	
6111 Taking a walk or hike that lasts at least 2 miles or 1 hour	
6119 Other walk or hike	
6120 Jogging and running	
6130 Biking skiing and skating	
6131 Biking	
6132 Skiing or skating	
6140 Unspecified ball games	
6141 Indoor pairs or doubles games	
6142 Indoor team games	
6143 Outdoor pairs or doubles games	
6144 Outdoor team games	
6149 Other specified ball games	

6150 Gymnastics	
6160 Fitness	
6170 Unspecified water sports	
6171 Swimming	
6179 Other specified water sports	
6190 Other specified physical exercise	
6200 Unspecified productive exercise	
6210 Hunting and fishing	
6220 Picking berries mushroom and herbs	
6290 Other specified productive exercise	
6310 Unspecified sports related activities	
6311 Activities related to sports	
6312 Activities related to productive exercise	
7000 Unspecified hobbies games and computing	Leisure screen time
7100 Unspecified arts	Socialising and hobbies
7110 Unspecified visual arts	

7111 Painting drawing or other graphic arts	Socialising and hobbies
7112 Making videos taking photographs or related photographic activities	
7119 Other specified visual arts	
7120 Unspecified performing arts	
7121 Singing or other musical activities	
7129 Other specified performing arts	
7130 Literary arts	
7140 Other specified arts	
7150 Unspecified hobbies	
7160 Collecting	
7170 Correspondence	
7190 Other specified or unspecied arts and hobbies	
7220 Computing - programming	Leisure screen time
7230 Unspecified information by computing	
7231 Information searching on the internet	

7239 Other specified information by computing	
7240 Unspecified communication by computer	
7241 Communication on the internet	
7249 Other specified communication by computing	
7250 Unspecified other computing	
7251 Skype or other video call	Socialising and hobbies
7259 Other specified computing	Leisure screen time
7300 Unspecified games	
7310 Solo games and play	
7320 Unspecified games and play with others	Socialising and hobbies
7321 Billiards pool snooker or petanque	
7322 Chess and bridge	
7329 Other specified parlour games and play	
7330 Computer games	Leisure screen time
7340 Gambling	
7390 Other specified games	

8000 Unspecified mass media	Socialising and hobbies
8100 Unspecified reading	
8110 Reading periodicals	
8120 Reading books	
8190 Other specified reading	
8210 Unspecified tv video or dvd watching	Leisure screen time
8211 Watching a film on TV	
8212 Watching sport on TV	Leisure screen time
8219 Other specified TV watching	
8220 Unspecified video watching	
8221 Watching a film on video	
8222 Watching sport on video	
8229 Other specified video watching	
8300 Unspecified listening to radio and music	Socialising and hobbies
8310 Unspecifiied radio listening	
8311 Listening to music on the radio	
8312 Listening to sport on the radio	
8319 Other specified radio listening	

8320 Listening to recordings		
9000 Travel related to unspecified time use	Work	Unless travelling by foot or bicycle, in which case time was coded to physical activity
9010 Travel related to personal business		
9100 Travel to/from work		
9110 Travel in the course of work		
9120 Travel to work from home and back only		
9130 Travel to work from a place other than home		
9210 Travel related to education		
9230 Travel escorting to/ from education		
9310 Travel related to household care		
9360 Travel related to shopping		
9370 Travel related to services		
9380 Travel escorting a child other than education		
9390 Travel escorting an adult other than education		
9400 Travel related to organisational work		

9410 Travel related to voluntary work and meetings	Socialising and hobbies	
9420 Travel related to informal help to other households		
9430 Travel related to religious activities		
9440 Travel related to participatory activities other than religious activities		
9500 Travel to visit friends/ relatives in their homes not respondents household		
9510 Travel related to other social activities		
9520 Travel related to entertainment and culture		
9600 Travel related to other leisure		
9610 Travel related to physical exercise	Physical activity	
9620 Travel related to hunting & fishing		
9630 Travel related to productive exercise other than hunting & fishing		
9710 Travel related to gambling		
9720 Travel related to hobbies other than gambling		

9800 Travel related to changing locality	Socialising and hobbies	
9810 Travel to holiday base		
9820 Travel for day trip/ just walk		
9890 Other specified travel	Work	
9940 Punctuating activity	Work	
9950 Filling in the time use diary		

Patterns of zeroes in the time-use composition

The most common pattern of time-use composition saw individuals reporting doing all activities (34%), then all activities except physical activity (32%), then all activities except physical activities and hobbies/socialising (9%). For physical activity, there were a large number of zero values (51% of participants). For other activity categories, there were a smaller number of zero values: 21% for hobbies and socialising, 11% for leisure screen time, 4% for other personal care, 4% for eating, and 3% for non-discretionary activities. There were no zero values for sleep as diaries reporting zero minutes of sleep were excluded in the quality control procedures.

Table A5: Model-adjusted compositional means (mins/day) by foodwork category for whole sample and population sub-groups

Parts	**Whole sample**			**Gender** Men			Women		
	None	Some	More	None	Some	More	None	Some	More
Personal care	77.32	73.31	66.33	66.95	67.37	62.81	93.81	80.33	73.23
Sleep	757.92	674.51	608.09	753.96	678.01	618.19	768.76	670.96	602.09
Eating	111.37	90.28	85.03	116.89	93.01	86.98	104.07	87.87	82.68
Physical activity	13.46	15.73	14.85	16.00	17.79	16.02	11.20	13.97	13.56
Leisure screen time	121.16	143.32	134.80	150.51	166.27	152.51	94.39	123.11	117.56
Work	279.31	356.20	459.46	263.81	329.08	427.73	270.13	377.35	480.57
Socialising and hobbies	79.46	86.64	71.44	71.88	88.46	75.77	97.64	86.41	70.32

Parts	Economic activity					
	Active			Inactive		
	None	Some	More	None	Some	More
Personal care	70.29	68.43	61.69	82.76	78.11	75.12
Sleep	729.75	674.40	637.71	803.42	683.72	604.77
Eating	95.15	79.18	79.28	137.40	109.68	98.61
Physical activity	12.29	14.88	13.71	12.75	13.76	13.85
Leisure screen time	119.39	142.54	146.30	141.92	167.11	141.82
Work	347.69	382.63	433.78	128.49	262.16	407.05
Socialising and hobbies	65.44	77.95	67.55	133.26	125.46	98.78

Table A6: Log-ratio difference between groups and bootstrapped confidence intervals

Parts	**Whole sample**				**Gender**							
					Men				Women			
	Some vs. none		More vs. some		Some vs. none		More vs. some		Some vs. none		More vs. some	
	LR[a]	CI[b]	LR	CI	LR	CI	LR	CI	LR	CI	LR	CI
Personal care	-0.05	-0.12, 0.03	-0.08	-0.14, -0.02	0.01	-0.09, 0.12	-0.07	-0.17, 0.04	-0.15	-0.28, -0.02	-0.09	-0.17, -0.01
Sleep	-0.12	-0.14, -0.09	-0.09	-0.11, -0.07	-0.10	-0.13, -0.07	-0.08	-0.11, -0.05	-0.13	-0.18, -0.09	-0.10	-0.12, -0.07
Eating	-0.21	-0.28, -0.14	-0.06	-0.11, 0.00	-0.24	-0.32, -0.15	-0.06	-0.15, 0.03	-0.16	-0.29, -0.04	-0.06	-0.13, 0.02
Physical activity	0.16	-0.01, 0.32	-0.04	-0.18, 0.10	0.09	-0.12, 0.31	-0.06	-0.28, 0.16	0.25	-0.01, 0.50	-0.02	-0.20, 0.16

Leisure screen time	0.16	0.05, 0.28	-0.05	-0.13, 0.03	0.09	-0.04, 0.22	-0.07	-0.20, 0.05	0.27	0.08, 0.47	-0.03	-0.14, 0.07
Work	0.25	0.17, 0.34	0.22	0.17, 0.27	0.24	0.13, 0.35	0.22	0.15, 0.29	0.32	0.18, 0.46	0.22	0.17, 0.28
Socialising and hobbies	0.09	-0.05, 0.23	-0.17	-0.28, -0.06	0.20	0.02, 0.38	-0.13	-0.31, 0.04	-0.11	-0.33, 0.12	-0.20	-0.34, -0.06

[a]LR = Log-ratio difference *between* foodwork categories, bold font signifies a statistically significant difference (p<0.017). Log-ratio differences are difficult to interpret numerically, and so in the text they are just presented as significantly higher or significantly lower. Numerically, a 'significant' difference is one where the confidence interval does not cross 0, the natural log of 1, indicating a ratio between equal proportions. Significant differences that are over 0 may be interpreted as significantly higher than the reference category, and significant differences that are under 0 may be interpreted as significantly lower than the reference category.

[b]CI = 98.3% confidence intervals constructed using a bootstrap technique; critical level was adjusted from 0.05 to 0.017 using the Bonferroni correction

Table A6: Log-ratio difference between groups and bootstrapped confidence intervals (continued)

Parts	**Economic activity**							
	Active				Inactive			
	Some vs. none		More vs. some		Some vs. none		More vs. some	
	LR	CI	LR	CI	LR	CI	LR	CI
Personal care	-0.02	-0.11, 0.07	-0.09	-0.17, -0.01	-0.06	-0.22, 0.10	-0.03	-0.13, 0.08
Sleep	-0.08	-0.10, -0.05	-0.06	-0.08, -0.03	-0.16	-0.21, -0.11	-0.11	-0.14, -0.08
Eating	-0.18	-0.27, -0.10	0.00	-0.08, 0.08	-0.23	-0.35, -0.10	-0.11	-0.20, -0.02
Physical activity	0.19	-0.01, 0.40	-0.06	-0.24, 0.12	0.08	-0.20, 0.36	0.00	-0.21, 0.21

Leisure screen time	0.18	0.05, 0.31	0.03	-0.09, 0.14	0.16	-0.04, 0.38	-0.16	-0.28, -0.04
Work	0.10	0.01, 0.19	0.11	0.06, 0.16	0.69	0.50, 0.90	0.43	0.36, 0.51
Socialising and hobbies	0.17	0.00, 0.34	-0.12	-0.27, 0.03	-0.06	-0.30, 0.18	-0.24	-0.41, -0.08

[a]LR = Log-ratio difference *between* foodwork categories, bold font signifies a statistically significant difference ($p<0.017$). Log-ratio differences are difficult to interpret numerically, and so in the text they are just presented as significantly higher or significantly lower. Numerically, a ‘significant’ difference is one where the confidence interval does not cross 0, the natural log of 1, indicating a ratio between equal proportions. Significant differences that are over 0 may be interpreted as significantly higher than the reference category, and significant differences that are under 0 may be interpreted as significantly lower than the reference category.

[b]CI = 98.3% confidence intervals constructed using a bootstrap technique; critical level was adjusted from 0.05 to 0.017 using the Bonferroni correction

APPENDIX 3: SUPPLEMENTARY MATERIALS FOR CHAPTER 5

Table A7: Full adjusted model of the association between home-prepared food consumption and DASH accordance (mutually adjusted for socio-demographic variables)

Explanatory variables	OR[a]	95% CI	P>|t|
Age group			
19-24 (ref.)			
25-49	3.2	1.5-6.9	<0.01
50-64	8.2	3.8-17.6	<0.01
65+	9.9	4.6-21.3	<0.01
Sex			
Male (ref.)			
Female	1.6	1.4-2.0	<0.01
Ethnicity			
White (ref.)			
Mixed ethnicity	1.8	0.6-4.7	0.27
Black or Black British	1.3	0.7-2.5	0.38
Asian or Asian British	4.6	2.8-7.4	<0.01
Other	1.0	0.5-2.0	0.94
Children living at home			
None (ref.)			
Children aged <16	1.0	0.7-1.3	0.97

Children aged <5	0.7	0.5-1.0	0.04
Educational attainment			
Degree level (ref.)			
12-13 years of education	0.6	0.5-0.8	<0.01
11 years of education and/or vocational course	0.5	0.4-0.7	<0.01
<11 years of education	0.3	0.2-0.4	<0.01
Equivalised income quintile			
5 (Highest) (ref.)			
4	0.9	0.7-1.1	0.24
3	0.7	0.5-0.9	0.02
2	0.7	0.5-1.0	0.04
1 (Lowest)	0.6	0.4-0.9	<0.01
Occupation			
Professional and managerial (ref.)			
Intermediate occupation	0.7	0.5-0.9	<0.01
Routine and manual occupation	0.7	0.6-1.0	0.05
Energy from home-prepared food	1.2	1.1-1.3	<0.01

Table A8 shows the results of a logistic regression with socio-demographic characteristics as the exposure and classification in the top quintile for DASH accordance as the outcome.

As in previous studies, DASH accordance varied extensively by demographic variables, with older people (OR 9.9(95% CI 4.7-21.0) for participants aged 65 and over relative to participants aged 19-24), women (OR 1.7(95% CI 1.4-2.1) relative to men) and Asian participants (OR 5.1 (95% CI 3.2-8.3) relative to white participants) being significantly more likely to be in the most DASH-accordant quintile. Participants with a lower educational attainment were less likely to be in the top quintile (OR 0.3 (95% CI 0.2-0.4) for participants with less than 11 years of education relative to participants with a degree-level education), as were participants in the lowest quintile of household income (OR 0.6 (95% CI 0.5-0.9) relative to top income quintile). Participants in intermediate roles were less likely to be DASH-accordant than their counterparts in professional or managerial roles (OR 0.7(95% CI 0.6-0.9)).

Table A8: Associations between DASH accordance and socio-demographic characteristics

Characteristic	n (%)	Relative DASH accordance			
		Proportion DASH-accordant (%)	OR[a]	95% CI	P>|t|
TOTAL	6364 (100)	19.8			
Age group					
19-24 (ref.)	645 (10.1)	5.0			
25-49	2761 (43.4)	16.7	3.2	1.5-6.8	<0.01
50-64	1547 (24.3)	28.1	8.1	3.9-17.2	<0.01
65+	1411 (22.2)	23.3	9.9	4.7-21.0	<0.01
Sex					
Male (ref.)	2640 (41.5)	16.0			
Female	3724 (58.5)	22.5	1.7	1.4-2.1	<0.01
Ethnicity					
White (ref.)	5907 (92.9)	18.9			

Mixed ethnicity	58 (0.9)	31.0		1.7	0.6-4.7	0.32
Black or Black British	133 (2.1)	27.1		1.7	0.9-3.2	0.09
Asian or Asian British	177(2.8)	39.6		5.1	3.2-8.2	<0.01
Other	82 (1.3)	24.4		1.3	0.6-2.5	0.51
Children living at home						
None (ref.)	4392 (69.0)	21.5				
Children aged <16	1103 (17.3)	18.4		1.0	0.7-1.3	0.99
Children aged <5	869 (13.7)	13.2		0.7	0.5-1.0	0.07
Educational attainment						
Degree level (ref.)	1461 (25.5)	33.6				
12-13 years of education	1505 (26.2)	19.3		0.6	0.5-0.8	<0.01
11 years of education and/or vocational course	1315 (22.9)	15.1		0.5	0.4-0.7	<0.01
<11 years of education	1457 (25.4)	13.0		0.3	0.2-0.4	<0.01
Equivalised income quintile						

5 (Highest) (ref.)	1061 (19.5)	30.0				
4	1093 (20.1)	24.3		0.9	0.7-1.1	0.32
3	1099 (20.2)	17.8		0.7	0.5-1.0	0.03
2	1067 (19.6)	16.2		0.7	0.5-1.0	0.05
1 (Lowest)	1132 (20.8)	12.8		0.6	0.5-0.9	<0.01
Occupation						
Professional and managerial (ref.)	2468 (40.7)	27.8				
Intermediate occupation	1911 (31.5)	17.1		0.7	0.6-0.9	<0.01
Routine and manual occupation	1684 (27.8)	12.0		0.8	0.6-1.0	0.06

APPENDIX 4: SUPPLEMENTARY MATERIALS FOR CHAPTER 6

Table A9 presents the demographic and socioeconomic characteristics of the analytic sample compared to the rest of the NDNS sample using a chi-squared test (except in the case of age, where a t-test was used). The analytic sample is different to the rest of the NDNS sample, particularly in having a higher prevalence of individuals with higher socioeconomic positions, as evidenced by their education, their income, and their occupation grade. Demographically, the analytic sample are older, less likely to be male, less likely to be white, and less likely to have children under the age of 16 living at home.

Table A9: Demographic and socioeconomic characteristics of analytic sample and rest of NDNS sample

Characteristic	High DASH analytic sample	Rest of sample	Total	Coefficient (95 %CI)/ x^2	p value
n	1063	5301	6364		
Demographic					
Age (mean (SD))	52.4 (51.2, 53.7)	47.0 (46.3, 47.8)	48.0 (47.3, 48.6)	5.4 (4.0, 6.8)	<0.01
Sex (% male)	42.2	50.0	48.6	22.8	<0.01

Ethnicity (% white)	82.8	90.4	88.9	74.9	<0.01
Children (% with a child aged <16)	28.3	32.3	31.6	18.6	<0.01
Socioeconomic					
Education (% degree)	38.7	22.6	25.5	127.4	<0.01
Equivalised income (% >£35,000)	36.0	26.8	28.5	38.4	<0.01
Occupation (% professional)	52.8	40.2	42.5	60.8	<0.01

Table A10: Adherence to nutrient guidelines for high and low home preparation groups

	High DASH				
Characteristic	High home preparation	Low home preparation	Total	OR (95% CI)[1]	p value
Daily nutrient intake					
% meeting guidelines					
Thiamin	96.5	98.0	97.1	1.4 (0.4, 4.6)	0.63
Riboflavin	74.5	86.7	79.4	1.7 (1.1, 2.7)	0.02
Niacin	99.9	100.0	99.9	N/A	
Vitamin B6	88.5	90.9	89.4	1.2 (0.7, 2.2)	0.54
Vitamin B12	96.2	96.1	96.1	0.6 (0.2, 1.6)	0.31
Folate	78.6	89.0	82.8	2.0 (1.2, 3.3)	<0.01
Vitamin C	94.8	95.3	95.0	1.0 (0.5, 2.0)	0.98
Vitamin A	76.8	68.9	73.7	0.6 (0.4, 0.9)	0.02
Calcium	63.2	77.6	69.0	1.6 (1.1, 2.3)	0.01
Phosphorus	99.7	99.8	99.7	1.2 (0.1, 12.6)	0.88
Magnesium	54.6	57.3	55.7	1.0 (0.8, 1.4)	0.87
Potassium	28.7	36.3	31.7	1.2 (0.8, 1.7)	0.42
Iron	61.9	69.5	64.9	1.0 (0.7, 1.5)	0.87
Zinc	64.6	58.3	62.1	0.7 (0.5, 1.0)	0.03

Selenium	25.3	15.3	21.3	0.6 (0.4, 0.8)	<0.01
Iodine	60.2	68.8	63.7	1.1 (0.8, 1.6)	0.47
Chloride	100.0	100.0	100.0	N/A	
Vitamin E	28.1	27.8	27.9	1.0 (0.7, 1.5)	0.80
Copper	55.2	52.0	53.9	0.8 (0.6, 1.1)	0.21
Manganese	97.0	98.3	97.5	1.7 (0.5, 5.1)	0.38
Biotin	22.0	19.8	21.1	0.7 (0.5, 1.1)	0.15
Pantothenic acid	48.4	52.1	49.9	1.0 (0.7, 1.3)	0.78
Fibre (≥30 g)	2.6	1.3	2.1	0.5 (0.1, 1.7)	0.26

[1]Adjusted for age, sex, ethnicity, children, education, income and occupation

Table A11 presents the proportion of individuals who eat food from each food group, while Table A12 presents the median grams of foods from each food group eaten daily by consumers.

Table A11: Percentage of individuals who eat foods from each food group by level of home-prepared food

Food group	High DASH		All	OR (95% CI)[1]	p-value
	High home preparation	Low home preparation			
Reduced fat milk	83.9	94.5	88.1	2.7 (1.5, 4.7)	<0.01
Whole milk	20.3	8.9	15.7	0.5 (0.3, 0.7)	<0.01
Other milk and cream	42.9	32.4	38.7	0.6 (0.4, 0.8)	<0.01
Yogurt, fromage frais and dairy desserts	56.1	65.9	60.0	1.5 (1.1, 2.0)	0.02
Butter	23.1	30.0	25.8	1.6 (1.1, 2.2)	0.02
Reduced fat spread	53.2	65.6	58.2	1.6 (1.1, 2.2)	<0.01
PUFA margarines and oils	12.1	8.0	10.5	0.7 (0.4, 1.3)	0.28

Food group	High DASH		All	OR (95% CI)[1]	p-value
	High home preparation	Low home preparation			
Other margarine, fats and oils	31.0	23.9	28.1	0.7 (0.5, 1.0)	0.08
Cheese	66.1	75.4	69.8	1.4 (1.0, 2.0)	0.06
Eggs and egg dishes	71.2	55.6	65.0	0.5 (0.3, 0.7)	<0.01
Brown bread	79.9	85.0	82.0	1.4 (1.0, 2.2)	0.08
White bread	59.8	65.8	62.2	1.3 (1.0, 1.8)	0.09
Other bread	6.4	11.0	8.2	2.1 (1.1, 3.7)	0.02
High fibre breakfast cereals	56.3	71.1	62.2	1.7 (1.2, 2.3)	<0.01
Other breakfast cereals	23.1	30.0	25.8	1.6 (1.1, 2.2)	0.02
Pasta, rice and other cereals	45.9	48.5	46.9	0.8 (0.6, 1.1)	0.26

Food group	High DASH		All	OR (95% CI)[1]	p-value
	High home preparation	Low home preparation			
Nuts and seeds	48.7	45.0	47.2	0.9 (0.6, 1.2)	0.44
Salad and other raw vegetables	93.4	91.9	92.8	0.8 (0.5, 1.5)	0.55
Vegetables not raw	100.0	98.0	99.2	N/A	
Fruit	98.2	98.2	98.2	0.8 (0.3, 2.4)	0.70
Fruit juice	51.9	53.1	52.4	1.2 (0.8, 1.6)	0.36
Smoothies 100% fruit and/or juice	1.7	2.0	1.9	1.4 (0.4, 4.7)	0.56
Biscuits, chocolate and candy	74.8	84.0	78.3	1.7 (1.2, 2.6)	<0.01
Ice cream	16.9	27.0	21.0	1.8 (1.2, 2.6)	<0.01
Puddings	22.1	20.8	21.6	0.8 (0.6, 1.2)	0.37
Buns, cakes, pastries and fruit pies	47.2	64.1	53.9	1.9 (1.3, 2.6)	<0.01

Food group	High DASH		All	OR (95% CI)[1]	p-value
	High home preparation	Low home preparation			
Sugars, preserves and sweet spreads	75.8	70.5	73.7	0.8 (0.6, 1.2)	0.25
Crisps and savoury snacks	29.4	39.4	33.4	1.6 (1.2, 2.2)	<0.01
Oily fish	42.9	36.8	40.5	0.6 (0.5, 0.9)	0.01
White fish breaded or fried	14.8	20.6	17.1	1.4 (1.0, 2.1)	0.07
Other fish dishes (incl. white fish and shellfish)	46.2	46.8	46.4	0.9 (0.7, 1.3)	0.65
Bacon and ham	3.8	6.0	4.7	2.2 (1.1, 4.4)	0.03
Pork and dishes	13.9	24.4	18.1	1.8 (1.2, 2.6)	<0.01
Sausages	18.7	19.4	19.0	0.9 (0.6, 1.4)	0.78
Beef, veal and dishes	43.8	33.2	39.5	0.6 (0.4, 0.8)	<0.01

Food group	High DASH				
	High home preparation	Low home preparation	All	OR (95% CI)[1]	p-value
Lamb and dishes	16.4	11.4	14.4	0.7 (0.5, 1.1)	0.17
Liver and dishes	6.4	7.7	6.9	1.1 (0.6, 2.1)	0.77
Chicken and turkey dishes	66.1	62.2	64.5	0.8 (0.6, 1.2)	0.31
Coated chicken	3.8	6.0	4.7	2.2 (1.1, 4.4)	0.03
Burgers and kebabs	4.7	4.9	4.8	1.0 (0.4, 2.1)	0.90
Meat pies and pastries	5.9	14.3	9.3	2.4 (1.4, 4.1)	<0.01
Other meat and meat products	45.9	48.5	46.9	0.8 (0.6, 1.1)	0.26
Chips, roasted and fried potatoes	42.7	49.9	45.6	1.3 (0.9, 1.7)	0.14
Other potato dishes	76.4	84.6	79.7	1.4 (0.9, 2.2)	0.13

Food group	High DASH				
	High home preparation	Low home preparation	All	OR (95% CI)[1]	p-value
Artificial sweeteners	11.1	15.6	12.9	1.4 (0.9, 2.1)	0.14
Dietary supplements	36.8	40.7	38.4	1.1 (0.8, 1.5)	0.67
Tea, coffee and water	100.0	99.5	99.8	N/A	
Soft drinks low calorie	24.5	33.4	28.0	1.6 (1.1, 2.4)	0.01
Soft drinks not low calorie	24.0	38.1	29.6	2.0 (1.4, 2.9)	<0.01
Beer, lager, cider and perry	22.0	27.5	24.2	1.2 (0.8, 1.8)	0.27
Wine	43.0	43.6	43.2	0.8 (0.6, 1.2)	0.32
Spirits and liqueurs	9.3	16.0	12.0	1.5 (0.9, 2.5)	0.13
Miscellaneous	98.2	94.2	96.6	0.3 (0.1, 0.7)	<0.01

[1]Adjusted for age, sex, ethnicity, children, education, income and occupation

Table A12: Median (IQR) grams of food eaten daily by high-DASH consumers of those foods

Food group	High DASH			Coefficient (95% CI)[1]	p-value
	High home preparation	Low home preparation	All		
Reduced fat milk	172.5 (88.1, 253.5)	190.0 (105.0, 292.5)	178.8 (96.3, 267.5)	12.4 (-10.0, 34.9)	0.28
Whole milk	52.5 (9.5, 159.2)	25.0 (10.0, 149.3)	50.0 (9.5, 159.2)	-5.9 (-13.6, 1.8)	0.13
Other milk and cream	21.0 (9.6, 62.5)	12.4 (7.5, 30.0)	16.3 (7.5, 48.8)	-16.7 (-36.2, 2.7)	0.09
Yogurt, fromage frais and dairy desserts	60.0 (31.3, 93.8)	68.1 (43.8, 100.0)	62.5 (32.5, 100.0)	13.1 (3.0, 23.3)	0.01
Butter	15.0 (7.5, 27.5)	20.0 (10.0, 30.0)	15.0 (9.0, 30.0)	2.6 (-1.4, 6.7)	0.20
Reduced fat spread	8.5 (4.3, 14.6)	11.2 (6.8, 17.0)	10.0 (5.0, 16.3)	2.1 (0.9, 3.4)	<0.01

Food group	High DASH			Coefficient (95% CI)[1]	p-value
	High home preparation	Low home preparation	All		
PUFA margarines and oils	1.9 (0.7, 7.8)	1.4 (0.4, 2.5)	1.5 (0.7, 4.5)	-1.3 (-3.1, 0.5)	0.16
Other margarine, fats and oils	2.9 (1.5, 6.2)	1.4 (0.7, 3.0)	2.6 (1.1, 4.8)	-1.4 (-2.3, -0.5)	<0.01
Cheese	18.3 (10.0, 30.6)	18.8 (10.0, 32.3)	18.5 (10.0, 31.3)	0.2 (-2.7, 3.0)	0.91
Eggs and egg dishes	30.0 (15.0, 45.0)	28.5 (14.3, 44.3)	28.5 (15.0, 45.0)	-4.8 (-8.7, -1.0)	0.01
Brown bread	49.7 (27.6, 72.6)	59.2 (33.5, 89.5)	52.2 (30.0, 82.5)	10.4 (5.3, 15.4)	<0.01
White bread	30.3 (18.0, 52.8)	36.0 (20.0, 73.0)	32.4 (18.7, 61.9)	10.5 (4.8, 16.2)	<0.01

Food group	High DASH			Coefficient (95% CI)[1]	p-value
	High home preparation	Low home preparation	All		
Other bread	24.5 (14.8, 38.6)	29.3 (20.6, 43.0)	25.9 (20.0, 38.8)	7.9 (-4.9, 20.7)	0.23
High fibre breakfast cereals	29.3 (15.0, 54.0)	36.6 (20.0, 66.0)	32.5 (17.5, 59.4)	3.2 (-4.4, 10.7)	0.41
Other breakfast cereals	15.0 (7.5, 27.5)	20.0 (10.0, 30.0)	15.0 (9.0, 30.0)	2.6 (-1.4, 6.7)	0.20
Pasta, rice and other cereals	12.5 (6.3, 25.8)	12.5 (5.8, 24.8)	12.5 (6.3, 25.0)	-1.3 (-3.7, 1.2)	0.32
Nuts and seeds	12.5 (5.6, 25.0)	9.7 (6.3, 20.9)	12.5 (5.9, 24.5)	-0.9 (-5.9, 4.2)	0.74
Salad and other raw vegetables	56.4 (24.3, 94.6)	63.6 (27.0, 103.4)	60.1 (26.3, 98.6)	6.7 (-1.3, 14.6)	0.10

Food group	High DASH			Coefficient (95% CI)[1]	p-value
	High home preparation	Low home preparation	All		
Vegetables not raw	190.2 (131.9, 259.4)	139.2 (95.0, 183.3)	163.1 (116.3, 232.3)	-52.3 (-63.7, -40.9)	<0.01
Fruit	196.0 (132.2, 301.3)	219.4 (145.2, 348.8)	203.9 (134.9, 314.6)	7.5 (-8.0, 23.0)	0.34
Fruit juice	77.5 (31.3, 150.0)	112.5 (50.0, 175.0)	93.8 (37.5, 150.0)	32.3 (14.5, 50.2)	<0.01
Smoothies 100% fruit and/or juice	66.3 (66.3, 198.8)	66.3 (43.5, 95.4)	66.3 (66.3, 95.4)	23.0 (-119.7, 165.7)	0.73
Biscuits, chocolate and candy	14.8 (8.1, 25.0)	20.4 (10.0, 40.0)	17.5 (8.8, 32.8)	11.3 (8.0, 14.6)	<0.01
Ice cream	30.0 (21.3, 50.0)	27.5 (16.3, 50.0)	30.0 (20.0, 50.0)	0.5 (-4.6, 5.5)	0.85

Food group	High DASH			Coefficient (95% CI)[1]	p-value
	High home preparation	Low home preparation	All		
Puddings	35.5 (22.5, 53.1)	27.5 (16.9, 50.0)	30.0 (20.0, 50.0)	-0.8 (-11.2, 9.7)	0.89
Buns, cakes, pastries and fruit pies	24.0 (14.0, 41.3)	30.0 (15.8, 54.5)	27.5 (15.0, 48.0)	5.8 (1.9, 9.7)	<0.01
Sugars, preserves and sweet spreads	12.0 (5.4, 20.2)	9.0 (3.8, 16.9)	11.0 (5.0, 19.6)	-0.3 (-2.2, 1.7)	0.78
Crisps and savoury snacks	8.1 (6.3, 13.8)	12.5 (6.3, 18.8)	9.0 (6.3, 17.3)	3.0 (0.9, 5.1)	<0.01
Oily fish	37.5 (25.0, 53.0)	28.1 (16.5, 40.0)	32.3 (22.3, 50.5)	-4.2 (-9.7, 1.4)	0.14
White fish breaded or fried	30.0 (25.0, 50.0)	28.0 (25.0, 37.5)	30.0 (25.0, 45.0)	-6.2 (-12.3, -0.1)	0.05

Food group	High DASH			Coefficient (95% CI)[1]	p-value
	High home preparation	Low home preparation	All		
Other fish dishes (incl. white fish and shellfish)	30.0 (18.0, 49.0)	28.8 (15.0, 43.3)	30.0 (16.3, 45.0)	-3.9 (-9.4, 1.5)	0.16
Bacon and ham	25.0 (15.0, 48.8)	23.8 (11.3, 31.3)	23.8 (11.3, 32.5)	1.4 (-13.7, 16.5)	0.85
Pork and dishes	30.0 (22.5, 45.0)	30.0 (21.3, 42.8)	30.0 (22.3, 42.8)	1.6 (-3.7, 6.9)	0.55
Sausages	28.4 (15.0, 38.0)	22.5 (15.0, 39.9)	26.2 (15.0, 39.9)	-3.6 (-9.2, 2.0)	0.21
Beef, veal and dishes	34.7 (23.4, 53.3)	29.2 (17.5, 39.8)	32.0 (21.0, 50.0)	-4.1 (-10.4, 2.1)	0.19
Lamb and dishes	40.0 (25.9, 54.2)	23.5 (19.3, 36.5)	35.0 (22.5, 47.9)	-15.5 (-26.8, -4.3)	<0.01
Liver and dishes	20.0 (10.0, 33.2)	20.0 (13.8, 25.6)	20.0 (12.5, 30.0)	1.2 (-5.1, 7.6)	0.70

Food group	High DASH			Coefficient (95% CI)[1]	p-value
	High home preparation	Low home preparation	All		
Chicken and turkey dishes	56.2 (32.5, 83.4)	40.5 (26.3, 65.0)	48.8 (30.0, 77.5)	-11.3 (-18.3, -4.3)	<0.01
Coated chicken	100.0 (60.0, 195.0)	95.0 (45.0, 125.0)	95.0 (45.0, 130.0)	6.0 (-51.4, 63.3)	0.84
Burgers and kebabs	25.0 (15.0, 53.8)	37.5 (8.5, 46.9)	25.0 (10.0, 50.0)	3.6 (-9.5, 16.7)	0.58
Meat pies and pastries	30.0 (22.5, 50.0)	37.5 (30.0, 45.8)	35.0 (25.0, 45.8)	0.5 (-9.4, 10.3)	0.92
Other meat and meat products	12.5 (6.3, 25.8)	12.5 (5.8, 24.8)	12.5 (6.3, 25.0)	-1.3 (-3.7, 1.2)	0.32
Chips, roasted and fried potatoes	46.0 (25.4, 64.4)	41.3 (25.0, 66.3)	41.3 (25.0, 64.4)	-1.4 (-6.8, 4.1)	0.63

Food group	High DASH			Coefficient (95% CI)[1]	p-value
	High home preparation	Low home preparation	All		
Other potato dishes	60.0 (40.0, 93.3)	65.3 (42.5, 110.0)	62.5 (40.5, 101.8)	10.3 (2.6, 18.1)	<0.01
Artificial sweeteners	1.0 (0.5, 2.6)	3.0 (0.9, 4.8)	1.5 (0.5, 3.8)	0.8 (-0.4, 2.0)	0.18
Dietary supplements	1.5 (1.0, 3.0)	2.0 (1.0, 3.0)	1.5 (1.0, 3.0)	-0.8 (-2.3, 0.6)	0.25
Tea, coffee and water	1288.4 (952.7, 1625.5)	1248.9 (899.3, 1635.5)	1264.3 (930.5, 1630.8)	15.3 (-64.1, 94.7)	0.71
Soft drinks low calorie	150.0 (82.5, 300.0)	142.0 (75.0, 325.0)	142.0 (75.0, 300.0)	6.7 (-96.1, 109.4)	0.90
Soft drinks not low calorie	100.0 (62.5, 160.8)	85.0 (50.0, 187.5)	91.8 (50.0, 175.0)	-15.2 (-53.0, 22.5)	0.43

Food group	High DASH			Coefficient (95% CI)[1]	p-value
	High home preparation	Low home preparation	All		
Beer, lager, cider and perry	165.0 (75.0, 322.9)	310.0 (141.8, 496.1)	225.0 (110.0, 425.3)	176.3 (85.1, 267.5)	<0.01
Wine	102.1 (43.8, 170.0)	129.0 (62.5, 218.8)	118.8 (46.9, 187.5)	27.1 (2.4, 51.7)	0.03
Spirits and liqueurs	21.0 (6.5, 25.9)	22.5 (11.5, 28.8)	22.5 (8.6, 28.8)	1.4 (-4.7, 7.5)	0.65
Miscellaneous	35.8 (14.0, 77.3)	34.3 (13.4, 81.3)	34.8 (13.8, 78.8)	-1.0 (-8.3, 6.2)	0.78

[1]Adjusted for age, sex, ethnicity, children, education, income and occupation

Table A13 presents the median DASH score of the complete NDNS adult sample compared to the DASH score of the subsample analysed in the study. As this is an analysis of a high-DASH subsample, their median DASH score is necessarily higher.

Table A13: Median DASH scores in complete sample and analytic subsample

Sample	Participants (n)	DASH score (median (IQR))
Complete NDNS adult sample	6364	24 (20,28)
Analytic subsample	1063	30 (29,32)